DOCUMENT RESUME

ED 372 237 CE 066 848

TITLE	The Year in Review. Volume 2: 1992-1993. Reports of Research Conducted by Adult Education Practitioner-Researchers from Virginia.
INSTITUTION	Virginia Adult Educators Research Network, Dayton.
SPONS AGENCY	Virginia State Dept. of Education, Richmond. Office of Adult Education.
PUB DATE	93
NOTE	98p.; For volume 1, see ED 356 406.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Academic Persistence; *Action Research; Adult Education; Adult Students; *Calculators; *Cooperation; Dropout Research; Educational Research; *Education Work Relationship; Failure; Fear of Success; Goal Orientation; Lifelong Learning; Literature Reviews; Mathematics Instruction; School Holding Power; Student Attrition; *Test Anxiety; Time Management
IDENTIFIERS	*Teacher Researchers; Virginia

ABSTRACT

This volume contains five reports of practitioner research projects within adult education programs in Virginia. "Learning in Everyday Life" (Susan Erno, Diane Foucar-Szocki) explores use of a monthly calendar as a time management and goal-setting tool for adult learners in a workplace setting. "Factors Related to Student Retention in Adult Education" (Antigone Barton et al.) is an examination of this issue in Virginia and in Cheshire, England. It concludes that two reasons for students choosing to stay are student responsibility for learning and the phenomenon of bonding in the classroom. "Why Do Well-Prepared Learners Delay Taking the GED?" (Barbara Guthrie) reports on research that found that the most dominant reason for delaying taking the General Educational Development (GED) Test was fear of both failure and success. "It's Almost Like Having Two Brains" (Laura Doyle, Susan Erno) examines the collaborative action research experience of adult education teachers and finds that the teacher-researchers appear to be very reflective, become experimenters or risk-takers, and share and learn from each other. "Calculator Use in Mathematics Instruction and Standardized Testing" (Martha Gilchrist) is a review of the literature from 1976-93. It examines three topics: the calculator in mathematics instruction, the calculator in standardized mathematics assessment, and a sample of research on the calculator in mathematics education. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 372 237

THE YEAR IN REVIEW

Volume 2: 1992-1993

Reports of Research Conducted by Adult Education Practitioner-Researchers from Virginia

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Distributed by:

THE VIRGINIA ADULT EDUCATORS RESEARCH NETWORK

BEST COPY AVAILABLE

CE 066848

This project is funded under Section 353 of the Adult Education Act, Title VI, P.L., 93-380 and amendments as administered through the Adult Education Office, Department of Education, Commonwealth of Virginia.

This activity which is the subject of this document is supported in whole or part by the U.S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education, and no official endorsement by the U.S. Department of Education should be inferred.

BEST COPY AVAILABLE

TABLE OF CONTENTS

Volume 2, 1992-1993

Introduction v

2.1 LEARNING IN EVERYDAY LIFE 1
A Study of Goal-Setting, Outside Class Learning Activities, and Time Management with Adult Students in a Workplace Class
Susan Erno and Diane Foucar-Szocki

2.2 FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION 15
A Study Conducted by Teacher-Researchers in Big Stone Gap, Richmond, and Fairfax, Virginia in conjunction with teachers in Cheshire, England
Antigone Barton, Joan Blankmann, Sandra Collier, Luke Fleischman, Sue McGuire, Patriciea Robbins

2.3 WHY DO WELL-PREPARED LEARNERS DELAY TAKING THE GED? 43
A Study of Test Anxiety Among Adult Education Students
Barbara Guthrie

2.4 IT'S ALMOST LIKE HAVING TWO BRAINS 57
A Study of the Collaborative Action Research Experience of Adult Education Teachers in Virginia
Laura Doyle and Susan Erno

2.5 CALCULATOR USE IN MATHEMATICS INSTRUCTION AND STANDARDIZED TESTING 71
An Adult Education Inquiry - Review of the Literature 1976-1993
Martha Gilchrist

Introduction

The Virginia Adult Educators Research Network promotes and supports practitioner-research among the Adult Education teachers in Virginia. During the past year, several teachers, working alone or with others, participated in the Network by designing and conducting research projects within their own programs. The following reports represent their findings.

Practitioner-researchers come from geographic areas throughout the state and work in a variety of Adult Education settings. Their "research laboratories" are their classrooms, their "subjects" are their students and fellow teachers, and their audience is the adult education practitioner who wishes to learn from another's experience. The researchers use existing research literature to support and focus their questions and, with the dissemination of their reports, add to the base of knowledge for others to access.

Copies of Year in Review, Vol 2, as well as Year in Review, Vol 1, which contains *Teachers Learning: An Evaluation of ABE Staff Development in Virginia* by Hanna Fingeret and Suzanne Cockley, are available from the Research Network office and from the Virginia Adult Education & Literacy Resource Center in Richmond. Copies of the individual reports are also available.

If you would like to correspond with individual researchers about their projects, please contact the Research Network and the staff will be happy to assist you.

THE VIRGINIA ADULT EDUCATORS RESEARCH NETWORK
PO Box 10
Dayton VA 22821
(703) 879-2732 or 1-800-336-6012
(703) 879-2033 Fax

LEARNING IN EVERYDAY LIFE: A STUDY OF GOAL-SETTING, OUTSIDE CLASS LEARNING ACTIVITIES, AND TIME MANAGEMENT WITH ADULT STUDENTS IN A WORKPLACE CLASS

Susan J Erno and Diane Foucar-Szocki

Introduction

Adult Education prides itself on adhering to responsive learner-centered practices. Yet, closer examination of much of our teaching suggests that adult education remains a prescribed teacher-directed activity. Bridging this gap between rhetoric and practice requires greater inquiry into teaching practices and learner needs. Learning how to learn, connecting life experience to classroom experience, and goal setting are important topics for the field of adult education.

This study sought to explore better ways to link class activities to learner lives and learning. We were interested in what learners identified as relevant outside of class activities. We used a monthly calendar as a time-management and goal-setting tool for adult learners in a workplace setting. This calendar also served as a communication vehicle.

The research questions for this study were:

1. What is the learner perception of the relationship between what goes on in the class and outside class activities?
2. What do learners record as relevant outside class activities?
3. What is the average amount of time learners spend on outside class activities?
4. Is there a relationship between outside of class activities and reading and math assessments?
5. Is there a relationship between outside class activities and the rate of reading, math and writing improvement?
6. Is there a relationship between outside class activities and length of time in the program?
7. Is there a relationship between goals and variety of and length of outside of class activities?
8. What is the evolution of goals over a six month period?

Method

This inquiry was conducted over a six-month period from November 1991 through May 1992 in a Virginia Department of Transportation sponsored workplace education class. Most of the program's participants had a long-term goal of receiving their GED. Two separate classes that each met four hours one morning per week were used. A total of 17 people are in the two classes, 15 male and 2 female. Three learners were functioning at Level I (4.9 reading level or below); six learners were working within the range of Level II (5.0 to 8.9); and eight were working at Level III (9.0 to 12.9).

All the class members submitted at least one calendar. Each learner's calendar, along with pre- and post-student surveys (Appendices A and B), reading and math assessments, and the teacher's classroom log and observations, served as the data sources for this study. We considered each learner as a separate case, taking notes on the classes as a whole and each learner specifically.

On the calendar (Appendix C), learners recorded their long-term and short-term goals for the month. Each learner listed the amount of time spent on outside of class activities that were relevant to their goals. The calendar also doubled as a class schedule, listing class dates, holidays, and special events.

Learner participation in this study was voluntary. An outside activity was any activity a learner identified as relevant. We were careful not to use the word homework to describe out of class activities.

Results

Tables 1-3 report Individual Learner data by reading level. The average number of outside activities recorded was 12.8 with a range of 1 to 30. Learners identified a total of 138 activities (Table 4) in six different categories of reading (42%), writing (16%), math and problem solving (16%), work related activities (12%), speaking or listening activities (9%), and family-member activities (5%).

One learner in Level I and II recorded more than twice as many learning activities as their peers. Two learners in Level III recorded learning activities above the mean.

Table 5 presents learner goals. Long-range goals varied only slightly with 76% wanting their GED. Only one long-range goal was specifically work related. Other short-term goals reflected activities largely defined by the long-term goal of passing the GED. There was no relationship between the type of goals listed and the variety or amount of time spent on outside of class activities.

The average monthly time spent on outside activities was 13.5 hours with a range of .5 to 64.5 hours per month. Table 6 reports the monthly averages of calendar recorded time. Eighty-eight percent of the population submitted calendars in January and February with a drop to 76% in March and 58% in April.

Seventy percent of the learners have been in the program for two years or more. The remaining 30% have been in class since June of 1991. The three learners reporting the most variety in outside of class activities have been in the program two years or more. Those with the lowest variety of outside of class activities had also been in the program for two years or more. There was no relationship between length of time in the program and outside of class activities or length of time spent on outside of class activities.

Eighty-two percent of the population showed an increase in reading and/or math ability as measured by the TABE or the READ test over the six month period. We could not determine what affect the calendar activity had on this increase, if any. Also, the assessment instruments did not allow us to determine a rate of improvement for each learner.

In the pre-survey, none of the learners said they were satisfied with their level of outside of class activity. When asked about their satisfaction with their outside of class activity in the post survey, 35% of the participation learners said yes, they were satisfied.

Discussion

First, learners had very individualized ideas about outside activities. Activities recorded reflected the lives of the individuals, although their stated long-term goals were quite similar. Many of the activities listed represent more traditional "homework." However, most learners did include one or more non-traditional activities like watching *Jeopardy*, reading the newspaper, or repairing a car.

Second, level of outside activity and perceived learning opportunities are not related to a learner's reading or math ability. These are influenced more by individual learner motivation and self-direction. Assumptions that assigning outside activities for Level I learners would cause undo stress (Easton, 1992) were unfounded using this approach. Learners at all levels recognized and recorded outside activities relevant to their goals. And they found time to dedicate to these activities. Several learners commented that the calendar itself served as a reminder, although they did not record every activity undertaken.

Third, the calendar served as an organizer, placing both class and other outside of class activities into the larger context of the learner's life. The calendar served as both an organizing and communication tool. Students used the calendar to record significant activities in their lives such as a family reunion or death of a close relative. Eighty-two percent of the learners said the calendar was helpful to them.

Fourth, learners had a difficult time writing goals. Short-term goals were particularly difficult. No evolutionary pattern in short-term goal evolution was present; however, learners acknowledged when they made progress. Learners agreed with the teacher that learning is a journey, somewhat analogous to travelling cross country. From the traveller's starting point, the final destination is the intended goal, for example, California. That intended destination is valued and understood, although not yet experienced. Yet, on the journey the traveller experiences other places which had been unknown before. During the

journey these places become known and valued, maybe even causing the traveller to change or alter his or her plans momentarily. The journey becomes enjoyable and valuable in and of itself. Arriving at the destination is no longer as central as it once was. The learner becomes a proficient traveller, relaxing more and enjoying all the new vistas opened up by the experience.

Brookfield (1986) speaks of this as not knowing our learning goal until after we've had our learning experience. Setting goals is important for determining a starting point. However, once the goals are in place we must remain open to additional learning opportunities that we could not define before. This was the experience of most of the learners in this study.

Finally, learners have less time in the spring and early summer months to work toward their goals outside of class. As spring began the number of calendars submitted and the amount of outside of class time spent declined. When asked, learners said that as the days grew longer so did their other recreational and family-related activities such as gardening, sports, car repairs, and family outings.

Implications for Practice

The calendar proved successful as both an organizing and communication device. Its use linked the teacher and the classroom with the lives of individual learners. It is a simple and practical method for making learning in everyday life more commonplace for all involved.

Additionally, the calendar served as a motivator to many of the learners. These learners interpreted the calendars use as an explicit reminder of their participation in class. They implicitly saw in it the teacher's expectation that they work toward their goals. Although this was unintentional on the teacher's part, learners made more of an effort because they thought it was what the teacher expected.

Many learners gain ground through watching television. Watching TV reinforces their reading. In this medium the printed work and the spoken voice appear together. Encourage learners to take advantage of this learning tool. It is likely that many lower level readers may not yet "see" the words on the screen. Teachers could point this readily available resource out to their learners. Also, teachers might consider using more audio-visual materials in the classroom.

Finally, learners take less time for outside of class activities in the spring and summer than in the winter. Planning learner work loads and lesson plans with this in mind is a good idea. Adults lead busy lives in which formal education is just one part. Responsive adult education recognizes this and responds accordingly. Adopting this simple calendar strategy can enhance learning in everyday life.

Attachments:

Table 1: Level I Student Data
Table 2: Level II Student Data
Table 3: Level III Student Data
Table 4: Outside Activities as Listed by Adult Learners
Table 5: Stated Adult Learners' Goals
Table 6: Monthly Averages of Calendar Recorded Time

Appendix A: Pre-Student Survey
Appendix B: Post-Student Survey
Appendix C: Sample Calendar

Table 1: Level I Student Data

Calendars submitted	# Outside activities last month times*	Hours last month*	Maximum time/month	Reading level 3/92	Math level 3/92	Increase in R/M?	Hrs./yr. 1st class	Satisfied with gains	Short-term Goals	Long-term Goals	Learner Reported Progress
5	30	22	16	272.	64.8	Y	390	Y	learn to read Bible study for ASE test help sons with homework, read Bible, read more	learn how to read better	I read better in parts book on job, use the computer, write work orders & keep up with engine records, read books to sons, and help with school work
5	9	2	8	8	?.	66.8	Y	585	Y	read One Fish, Two Fish, Bunches in Bunches, Cowboy Andy, read 20 minutes per day	read and write better.	I can read better. I can Cowboy Andy & The Foot Book. I write better.
3	3	4	8	8	5.	45.7	Y	487	N	none listed	read better, write, GED	I read better. It's easier to read a letter or magazine.

* Times are rounded to nearest hour
1. R/M denotes reading and/or math
2. ooa denotes time spent on outside activities

Data Sources: Calendar entries, Surveys and interviews with students, TABE and READ tests

Table 2: Level II Student Data

Calendars submitted	# Outside activities last month times*	Hours last month*	Maximum time/month	Reading level 3/92	Math level 3/92	Increase in R/M?	Hrs./yr. 1st class	Satisfied with gains	Short-term Goals	Long-term Goals	Learner Reported Progress
5	24	3	28	26	8.	58.0	Y	390	Y	take math practice test, more tests	GED	I read better. I understand what I read much better.
1	1	6	6	6	9	29.0	Y	650	N	read and spell better	read and spell better, get waste water license	I can read better and spell better.
5	10	6	6	9	62	7.9	N	390	N	reading, math, write 1 page/week	reading, writing, spelling, GED	Writing comes helpful and I can explain more in my writing.
4	7	14	6	365	-	-	-	390	Y	more work on the computer, more reading, learn at least 10 words/wk.	GED, more reading and words	I understand more words this year. I have a computer and I can work the computer more.
2	6	7	1	7	10	7.7	Y	390	N	math	GED	a lot more math
6	13	3	4	15	27	7.6	Y	390	N	do better in math, reading, keep my family and school	GED, do better in math, writing, spelling	I read better, do math and spelling better. I'm able to understand general school work better. I pay bills now using a checkbook. I read faster.

Table 3 Level III Student Data

# Calendars submitted	# Outside activities	1st month time *	Last month time *	Maximum time/month	Reading level 3/92	Math level 3/92	Increase in R/M?	No./yr. 1st class	Satisfied with goals	Short-term Goals	Long-term Goals	Learner Reported Progress
3	1	2	2	8	3	4	9.6	11	Y	5	91	Y	Keep studying in case I have to take the GED again; go to Piedmont Tech., pass Lit. and Arts test	GED	I understand math a lot better.
4	1	3	2	0	2	0	8	8.0	Y	5	91	N	work on social studies, pass soc. studies test by 2/92, take pretest	GED	I can do a lot more geometry, algebra, math, spelling, and writing.
5	4	9	4	9	2	5	12	9	Y	6	91	Y	work on math, reading, learn to spell better, learn more about writing, social studies	More reading, writing, spelling, GED	I write better than I could last year.
5	4	8	1	0	1	7	9.	4	7.4	N	6	8	9	N	read more, read 10-15 min./day, write 4-5 papers/ month, study harder	reading, spelling, and writing, GED	I can read, write, and do math better.
4	8	3	9	9	9.	9	12	9	Y	9	0	N	read more, work on math	GED	I read better, do math, do all class better.
3	2	0	2	1	1	3	1	2	9	8.0	Y	6	8	9	N	none listed	GED	I think that I'm able to write an better essay than I could last year.
5	8	12	12	15	7.	5	6.	1	Y	9	0	N	Learn multiplication tables, try to do 20 pages in math book	GED, complete fractions	Fractions.
5	9	3	2	5	2	5	8.	9	12	9	Y	9	0	N	pass social studies test, sci. and math tests, pass all practice tests	GED	I write and spell better, do math better.

* Times are rounded to nearest hour
1. R/M denotes reading and/or math
2. osa denotes time spent on outside activities

Data Sources: Calendar entries, Surveys and interviews with students, TABE and READ tests

BEST COPY AVAILABLE

Table 4: Outside Activities as Listed by Adult Learners

Category	# Students
Reading	
General (no specific material mentioned)	9
Newspapers	14
Bible	6
Read to children/grandchildren	6
Social Studies	5
Books	4
Maps/map study	4
Help children with their homework	4
Science posttest and review	3
Magazines	2
Literature and Arts pretest	2
Worked on computer	2
Science practice test	2
Science	2
Read signs	2
Laubach Way to Reading	2
Children's literature (14 different books)	2
Literature and Arts practice test	2
Social Studies practice test	2
Help child learn to read	2
Bible lesson	2
Practice test	2
Studied and took Science pretest	1
Read directions on chemicals at work	1
Read want ads	1
Word puzzles/crosswords	1
Read at work	1
Read mail	1
Read "Narrative of F. Douglass"	1
Read school story	1
First Aid book	1
GED book	1
Car book	1
Review pretest	1
Literature and Arts	1
Parts book	1
Hunting books	1
Study ASE test (auto mechanic)	1
Hooked on Phonics tapes	1
Checking out engine parts	1
"How to do your Banking"	1
Read on break and lunch hour	1
Read off T.V. ads and news shows	1
Try to read everything I see	1
Teach children phonics	1
Read "Just for Today"	1
Try to pick out words in a newspaper	1
Farm Chronicle	1
Farm Bureau paper	1
Took GED test	1
Writing Skills practice test	1
Hunting magazine	1
Political Science	1
Geography	1
Seeing words and spelling them back	1
Sunday school and church services	1
Read parent's note about trip	1
Read at work-safety meeting	1

Writing Activities

Writing (no specific activity mentioned)	8
Write essay	4
Do taxes	4
Spelling	4
Filled in calendar	2
Wrote checks	2
Writing "A Christmas Memory" (assignment)	2
Word puzzles	1
Pay bills	1
Typing	1
Computer	1
See words and spell them back	1
Pre-write essay	1
Write from the Bible	1
Writing words	1
Working with Quickword Dictionary	1
Filling out work orders	1
Spelling book	1
Write word lists	1
Writing for Farm Chronicle	1
Spelling with wife	1
Capitalization and punctuation review	1

Math/Problem-Solving

Math (no specific activity mentioned)	12
Working taxes	4
Working with computer/programming sign	3
Fractions	2
Whole number review	2
Percents	2
Pay bills	1
Checked over grocery bill	1
Worked checks	1
Worked on cars	1
Decimals	1
Problem-solving exercise	1
Class on road paving	1
Study multiplication	1
Doing carpentry work/building	1
Learned how to use a ruler	1
Figured out how much material to use on a job	1
Defensive Driving course	1
Math for farm	1
Math with wife	1
Math practice test	1
Help granddaughter count	

Activities Involving Family Members

Read to children/grandchildren	6
Help children with their homework	4
Help child learn to read	1
Help granddaughter count	1
Help son with spelling words	1
Spelling with wife	1
Math with wife	1

Work Related Activities

Read directions on chemicals at work	1
Class on road paving	1
First Aid Class	1
Run computer board sign	1
Carpentry work/building	1
Read at work-safety meeting	1
Figure out how much material to use on the job	1
Read parts book	1
Study ASE test	1
Checking out engine parts	1
Filled out work orders	1
Work in shop	1
Defensive Driving course	1
Math for farm	1
Writing for Farm Chronicle	1
Read Farm Chronicle	1
Read Farm Bureau paper	1

Speaking/Listening Activities

Sunday school/church services	1
Class on road paving	1
Class on defensive driving	1
Evening GED Class	1
Read in safety meeting	1
Discussion in bible study class	1
TV-Top Cop	1
TV-Wildlife and science programs	1
TV-Jeopardy	2
TV-Wheel of Fortune	1
TV-news	2
TV-State of the Union Address	1

Table 5: Stated Adult Learners' Goals

Goal	# Students
Get GED	13
Get GED by specific date	9
Reading	9
Write better	5
Spelling	5
Read more	4
Spell better	3
Math	3
Social Studies	3
Study harder	2
Take pretests	2
Pass Social Studies practice test	2
Use computer	2
Pass Wastewater test	1
Fractions	1
Read 10-15 minutes per day	1
Write 4-5 papers per month	1
Grammar	1
Pass Science test	1
Pass Math test	1
Pass all tests	1
Read more	1
Work more on math	1
Go to Piedmont Tech.	1
Pass Literature and Arts test	1
Learn geometry	1
Learn to read the Bible	1
Study ASE test	1
Help sons with homework	1
Read Bible	1
Learn how to read	1
Write 1 page per week	1
Learn multiplication tables	1
Do 20 pages in math book	1
More work on the computer	1
Learn 10 new words a week	1
Read "One Fish, Two Fish"	1
Read 20 minutes per day	1
Read "Hunches and Bunches"	1
Read "Cowboy Andy"	1
Keep my family and school up on my own	1
Take math pretest	1
Write more	1

Table 6: Monthly Averages of Calendar Recorded Time

MONTH	# of Calendars Submitted	Average Time Spent Outside Activities
Nov. 91	4	10.7
Dec. 91	10	10.0
Jan. 92	15	12.7
Feb. 92	15	13.6
Mar. 92	13	18.8
Apr. 92	10	12.4

Appendix A: Pre Student Survey, January,1992

NAME_____ DATE_____

1. What is your goal?

2. List all the outside class activities you do that will help you meet your goal.

3. How do you think these activities help?

4. How much time do you currently spend outside of class on activities that will help you meet your goal?

5. How much time do you think you should be spending on these activities?

Appendix B: Post Student Survey

Interview Questions May 1992

What is your goal?

What can you do now that you couldn't do last year?

Was it helpful to complete the monthly calendars? Please explain.

Will you continue to use the calendars?

List all outside class activities you do that will help you meet your goal.

After reviewing your calendars, are you satisfied with the amount of time you spend outside of class on goal related activities?

BEST COPY AVAILABLE

May, 1992

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6 CLASS NEVA WILL DO READING	7	8	9
10	11	12	13 CLASS	14	15	16
17	18	19	20 CLASS	21	22	23
24	25	26	27 CLASS	28	29	30
31						

LONGTERM GOAL_____

GOAL FOR MAY_____

Bibliography

Brookfield, S.D. Understanding and Facilitating Adult Learning. San Francisco, CA. Jossey-Bass. 1986.

Easton, T. "Out of Classroom Literacy Activities for Adult Reading Students." unpublished paper, Department of Education, Virginia Commonwealth University, Richmond, VA. 1992.

FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION

A Study Conducted by Teacher-Researchers in Big Stone Gap, Richmond, and Fairfax, Virginia

Suzanne Cockley

Background

In September 1992 the Virginia Office of Adult Education asked the Research Network to coordinate a study of student retention, using teacher-researchers to examine the issue in Virginia and Cheshire, England. The Network, in collaboration with Mr. Alistair Tranter in Cheshire, decided to involve six teacher-researchers in Virginia, representing urban, rural and ESL Adult Education settings. This report will discuss the activities and findings of the Virginia researchers.

Advertizing through adult education administrators in Fairfax County, Wise County, and Richmond, the Network located two teachers in each area who were willing to participate. The Network coordinator met with these six teachers in September to discuss shared experiences with students who drop out. We decided to identify student "drop-outs" as those adults who register for an adult education class but leave before having reached their stated goal. This goal is often the GED, but any stated student goal is acceptable for the purpose of this study.

All the teachers in the group had some experience with students in their class dropping out. They recounted things they had done to try to prevent or reverse this - class socials, "we missed you in class" postcards, follow-up phone calls, etc. All the teachers pointed to the more commonly given reasons for dropping out - trouble with transportation, lack of child care, illness, or a change in work schedule. They also listed internal conditions, such as lack of confidence or fear of failure, as possible reasons why students left before reaching their goals. The teachers acknowledged that losing a student was a difficult experience for a teacher, often making him or her wonder if the student had left because the teacher or the teaching methods were "wrong". The teachers speculated upon program based reasons for dropping out. Teachers who work with students who are mandated to attend class (because of social services or judicial requirements) noted, not surprisingly, that these students appeared less motivated than students who decide on their own to attend class.

Based on the discussion of possible reasons for students dropping out, the teachers formed study teams of two in each area and chose a specific research question they wished to pursue. There were many possible avenues of study left unexplored - the participants chose questions which interested them the most and seemed to be relevant to their own classroom situations. Having picked a research question, the group discussed ways in which each team might gather information pertinent to their study. All participants agreed to keep a personal journal, where they would write about their daily classroom experience and their research.

The Big Stone Gap team studied student expectations of adult education class, and the students' assessment of the class after they had spent some time there. This team used telephone interviews and a written survey to gather information.

The Richmond team studied students perceptions of why adults drop out. They gathered information from video-taped personal interviews (with students who had dropped out as well as students who remained) and student writing assigned in class.

The Fairfax team, working exclusively with ESL students, chose to study the effects of class bonding on student retention. They used classroom observation and interviews with other ESL teachers to gather information. They included a case study of one class in their data.

Findings

The teams came back together in February to share their data and analyze their findings. All the teachers heard students citing reasons for leaving class which have always appeared in the research literature - transportation, illness, fear of failure, etc. The interviews provided indications that most students - both those who leave and those who stay - experience some of these problems. The researchers became interested in examining possible differences between these two groups. What causes students to stay in class when they experience the same problems that cause others to leave? Again, an examination of the interviews and student writing provided some clues. Again and again, students said that you had to really want an education - you had to "have a mission" - in order to stick it out. Students used phrases such as "you got to want the prize" to illustrate the needed motivation and "you got to decide to do this for yourself, because you want to improve your life" to show that students who stick with it are students who have claimed responsibility for their own learning. The researchers speculated that several conditions may be critical for this to happen. These conditions, and their possible relationship to student motivation and responsibility, are areas for further research. They include:

1. Acknowledging and accepting past experiences in school
2. Dreaming about the future - setting a perfect plan and then making it more realistic
3. Setting a realistic goal and time line
4. Supportive teachers who care, but do not stifle - this may mean actively refusing to be depended upon
5. Non-academic support (connections with various social services agencies, job-search help, etc.)

Another look at the survey data revealed a tendency for students to drop out of a program after the class was canceled for a holiday or when the regular teacher was not there and a substitute was present. This led to a discussion of dependency and responsibility for learning. The researchers could not draw any definite conclusions from the data, but some interesting questions were raised about the student/teacher relationship and the effect it has on the amount of responsibility for learning that the student is willing to accept.

An additional area of discovery for the teacher-researchers was classroom bonding and its effect on student retention. Defining bonding was a problem. The researchers working with ESL classes were able to use the length of time students maintain non-instruction conversation in English with each other as a measure of how "bonded" the class was. The more time students spent talking informally with each other, the more teachers considered the class "bonded". They also identified activities which teachers felt increased bonding in their classes. While most of the teachers who were interviewed and surveyed felt that certain bonding activities increased student retention, the definitions of bonding were too non-specific, and the effects of these activities upon retention were too anecdotal, to make any statement to this effect.

There are factors other than planned class activities which may influence bonding among students. One of the classes studied is made up entirely of people from the same community - many of whom are related to each other. Workplace classes, in which all the students work on the same shift, are also bonded externally; that is, by something other than shared participation in a class. The researchers discussed the difference between an externally bonded group, such as these, and a regular adult education class where the students do not necessarily know each other. ESL classes represent yet another model of bonding. ESL students in a particular class may live in many different communities and have a variety of cultural backgrounds. These students have been even less externally bonded than the students in a regular adult education class, who at least live in the same general community and share a national culture. However, ESL students do share one powerful bond in common. The experience of being a stranger in a foreign land creates strong ties with fellow foreigners. This experience also facilitates a powerful student/teacher

relationship. Both the concept of bonding and the concept of learner dependency appear altered in the ESL setting.

Conclusions and Recommendations for Further Research

Conclusions from this study may be drawn from several different perspectives. Most of the data was collected systematically, however, the findings and discussions based on those findings are still anecdotal. It is not possible to make any solid statements about retention based on this study. However, the questions raised by this process are more sophisticated and detailed than the questions at the beginning. It is probably most accurate to view this study as a work in progress. The data collection and analysis to date compromise a preliminary study of retention which helps the researchers, and others reading this report, focus further research. The two focal points of the study - student responsibility for learning and the phenomena of bonding in the classroom - both show promising avenues for deeper inquiry. In the case of student responsibility for learning, we need to examine the student/teacher relationship and its role in facilitating or hindering the fostering of learner responsibility. The phenomena of bonding presents problems of definition and measurability. The data indicates that teachers feel certain class activities increase bonding and that bonding increases retention. Can this be shown? Both of these areas of study need to be examined in ABE as well as ESL settings.

This study should also be evaluated as a staff development activity. Each researcher reported that the process was very time consuming and more complicated than they had first thought. Most found that writing about their research was difficult but rewarding. They gained new insights into their study as they struggled to put words on paper. They witnessed first hand some of the pitfalls of creating and using surveys and video-taping live interviews. All of the teacher-researchers experienced moments of revelation as they collected data and analyzed it with each other. Each one reported at the end of the project that they were excited about their project and that they would like to continue their studies in some form.

Literature Review

It is estimated that, nationally, 40-60 percent of Adult Education students drop out of class before reaching their stated goals. Examination of the reasons behind this high attrition rate has produced a variety of findings, often contradictory and inconclusive.

Before considering the array of factors which contribute to the drop-out rate, we should consider a point concerning the definition of the term "dropout". Different Adult Education programs, and thus different research studies, define a dropout differently. Some count all students who registered but never returned; some consider a student to have dropped out if a specific number of class hours have been completed; still others count only if the student has officially withdrawn.

As important as how the students are counted might be the question of why they are counted as dropouts in the first place. Some students come to class with very specific (if unarticulated) literacy goals; when those goals are met, the student stops coming. They may return at some future time to work on another goal. Is it correct to characterize these students as "dropouts", or should they be considered "successes", or perhaps just "lifelong learners?"

> Some students do need to take breaks from learning. It is hard going to study consistently when one has not been used to it. We need to re-think our notion of "drop-out" for the low-literate population. Many learners are in for a long haul and program sponsors need to recognize this fact. (Thomas, 1989)

BEST COPY AVAILABLE

Typical Reasons

Assuming, as most studies do, that a "dropout" is one who has withdrawn from class voluntarily after initial attendance, we can examine the variety of reasons cited by students in surveys and interviews. Most studies arrange the reasons in 3 or 4 broad categories. Terminology may differ, but in general, the 3 primary factors are: 1) Personal (Psychological, Situational); 2) External (Environmental, Non-school related); and 3) Institutional (Academic Program).

Most studies into this area have, by necessity, focused upon an individual locality and program. The findings from these studies have often been contradictory. The individual nature of programs (how they recruit, how they structure their classes, even their urban or rural location) can have a great deal of influence upon the outcome of the studies. For example, numerous studies list "lack of transportation" as one of the external factors affecting drop-out rates. But the percentages for this one factor vary considerably between studies, depending on whether the locality has public transportation available or not. The weight of this factor in turn affects other percentages, making research results quite individualized and sometimes contradictory.

In general non-school related (personal or external) reasons are the most frequently given by respondents, although it has been speculated that these causes may be more socially acceptable than placing "blame" on the program or teacher/tutor. (Cramer, 1982)

External factors may be the lack of transportation to the class site, a lack of adequate child care, or other factors over which the Adult Education program may have little control. The solution to these problems often rests with outside social service or governmental agencies, although assistance may be given by encouraging the class to work at car-pooling or providing child-care options on site.

The single most frequently given reason for dropping out is some type of job related difficulty. Either the schedules for work and class do not mesh conveniently or the balancing required to combine work with class is too difficult to overcome. In the personal area, dropouts often cite family difficulties as a primary cause. The mix of home and child rearing responsibilities with class is too demanding. Students also tend to underestimate their own abilities to succeed in class. This is often caused by their past school experiences. Students may have a negative perception of the value of education, again stemming from earlier bad experiences, and this can lead to early attrition.

Among the academic reasons or school related reasons for dropping out, the most often cited is "making no progress." This lack of progress may be genuine, or it may be an inaccurate perception of the student. Often adult students set goals too long-term or too unrealistic and become dissatisfied when those goals are not quickly reached. If they can be directed toward shorter-term, more attainable goals, their perceived success is greater and their satisfaction higher. Other academic reasons pertain to the institution - inappropriate placement in courses, incompatible student/teacher match, or material which students do not find relevant to their lives.

It should be noted that the types of reasons given for withdrawal remain fairly consistent regardless of how long a student was enrolled, but the frequency and strength of individual factors changes as the length of the student's stay increases. For instance, among early dropouts, academic reasons rank the highest. The student may find that the course is not what was expected; they may be "turned-off" due to cold or impersonal institutional staff; or the process used for placement in classes is intimidating. As time passes, and the everyday stresses of juggling school and work/home become more marked, the external and personal factors play a larger role. Gradually, the reality of this new endeavor hits home and the students who cannot overcome the difficulties drop out.

Other Factors

A major influence which should be recognized by Adult Education teachers and programs is the significant impact of students' peers on their attitudes and persistence in an educational program. Spouse, family, work-mates, and classmates must be considered part of this peer group. Indeed, a strong supportive group within the classroom "has been judged so valuable that it can work to offset the problems associated with large classes" (Brod, 1990)

Some researchers cite an additional influence which impacts the "staying power" of students. Why is it that factors and life events which cause some students to drop out do not have the same effect on other students? Cross suggests that those who are able to persist in their studies have an internal motivating force which allows them to overcome the outside difficulties. If the motivation is not strong enough, other things take precedence over education. (Cramer, 1982)

Lemming (1980) stated that students who remain in programs do so because they have a "willingness or ability to endure dissatisfaction". They are able to "get past" the difficulties and balancing act associated with attending class, while other students allow the difficulties to overwhelm them. This argues that the reasons for "sticking it out" as opposed to dropping out lie in a combination of qualities within the student as much as in the often given reasons discussed above. (Parkinson, 1987)

> Adults make a choice to enter a program and make a choice when to leave a program. Although problems such as illness, transportation, time, and family concerns can prevent a student from attending a class, students will continue in a program despite these problems if they find the classes to be comfortable, challenging, interesting, and worthwhile. (Ratcliff, 1983)

Indeed, many dropouts do return again and again to the Adult Education programs. When surveyed, large numbers (as many as 80% in one survey) state that they enjoyed the program and fully intend to return when able. When personal circumstances allow, when they have settled into a new home or job after relocating, when they have gained control over personal difficulties, they "drop back in". These positive attitudes toward Adult Education were noted in many studies.

Directions for Future Research

While current research indicates that many reasons for dropping out are common to all Adult Education programs, it would be inappropriate for an individual program to assume to know the causes behind their retention difficulties. Specific local research, conducted through surveys or interviews, should be utilized. Programs should ask their own questions to discover the concerns of their students. With that information, consideration should be given to what steps can be taken to address or alleviate some of the difficulties faced by these students.

Bibliography

Association for Community Based Education. "Adult Literacy: A Study of Community Based Literacy Programs," 1986.

Bean, Rita, and others. "Attrition in Urban Basic Literacy Programs and Strategies to Increase Retention," Institute for Practice and Research in Education, 1989.

Bolmuth, Mariam. "Recruitment and Retention in Adult Basic Education: What Does the Research Say?" Journal of Reading, V 31, 1988.

Brod, Shirley. "Recruiting and Retaining Language Minority Students in Adult Literacy Programs," Office of Educational Research and Improvement, Washington DC, 1990.

Cramer, Patricia L. "Causes for Attrition Among Adult Basic Education Students," Masters Thesis, Bowling Green State University, March 1982.

Jackson-Mayer, Sheila. "Strategies for Success. A Study on ABE Student Retention," Coastal Carolina Community College, Jacksonville NC, 1987.

Knibbo, Marie Vannozzi and Dusewicz, Russell. "A Research Study in Retention," Center for Literacy, Inc. Philadelphia, 1990.

Leonard, Rex. "Factors Contributing to the Attrition of Adult Basic and Secondary Education Students," Paper presented to the Mid-South Educational Research Association Meeting, Memphis TN, 1986.

Parkinson, Kevin. "Attrition of Part-Time TAPE Certificate Students," TAPE National Centre for Research and Development, Payneham, Australia, 1987.

Quigley, Allen. "Beyond the Classroom," Adult Learning. Vol VI, 1990.

Ratcliff, Sandra. "Recruitment and Retention of Adult Basic Education Students," NAAESC Occasional Papers, Vol I No 3. Northern Illinois University, Northern Area Adult Education Service Center, 1983.

Thomas, Audrey. "Encouraging Adults to Acquire Literacy Skills," National Literacy Secretariat, Ottawa, Canada, 1989.

FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION

The Role of Goal Setting and Motivation in the Retention of Students in Adult Basic Education Programs

Antigone Barton and Luke Fleischman

Introduction

The purpose of this report is to present the methods and outcome of a qualitative research project that Luke Fleischman and I undertook between September 1992 and March 1993. In our research, Luke and I sought to discover the factors that cause students to leave Adult Education programs early, and cause other students to stay.

Luke is a counselor at the Adult Career Development Center and an administrator of the Center's night school. His roles include intake, assessment, scheduling, and helping incoming and continuing students to identify goals and needs. I am a teacher in the Richmond Public Schools' Satellite Programs. When our research began I was teaching GED classes in three settings - a neighborhood church, a perinatal rehabilitation center, and a community college. Most of the students Luke and I work with live in Richmond's inner city and many are reliant on some form of public assistance.

The Adult Career Development Center houses a number of adult education programs accommodating different student circumstances as well as different student academic levels, educational needs, and vocational goals. One program, for example, the Total Learning Cooperative, works with the local social services department to meet the academic requirements of mandated students (who must attend school to receive public assistance benefits). Other programs, such as the family literacy Even Start program, also attract mandated students but were designed specifically to help parents support their young children's educational experiences. Other programs are structured around the needs of adolescent students who have left high school. The Center also serves students in English-as-a-Second Language (ESL), as well as students in vocational programs (such as Geriatric Nursing and Offices Practices).

Methods

In September we joined the retention study group of the Virginia Adult Educators' Research Network to examine factors influencing students' departure within the first twelve hours of instruction. In a first meeting with other team members in Roanoke, we talked about students' past educational experiences, goals, pressures, obstacles unique to adult students, and the interaction of these with the educational environment.

Luke and I felt that all of these elements affect our student population. We decided then to approach our research with open-ended questions, using interviews, focus groups, student discussion, and writings.

Luke had also developed a tracking form during the previous semester in which teachers could give information about students' durations of attendance, reasons for leaving, and students' pre and post instruction academic levels.

We reviewed data from forms that has been returned to Luke the semester before and Luke interviewed some of the teachers who had returned those forms. We found that the majority of students who had left within the first twelve hours of instruction left without providing a reason or an indication of future plans. A smaller number of students had made contact with a teacher or counselor and all of these students had indicated that outside factors such as health, transportation, family concerns, and financial constraints necessitated their departures. We also saw that ESL and vocational programs had lower early departure rates than basic academic and GED skills courses had.

I developed a set of writing assignments designed to build students' persuasive and expository essay-writing skills and to focus on students' educational concerns, experiences, and expectations.

The first of these assignments asked students to describe the school subjects that they had liked and not liked in the past, to explain their preferences/aversions to those subjects, and to suggest ways in which the subjects that they had not liked could be made more enjoyable. I gave that assignment early in the semester at the first class meeting. I found that while many students expressed intimidation, discouragement, and resentment in describing their past educational experiences, no student carried that tone into writing that voices suggestions or future expectations.

Luke and I also kept individual journals in which we each recorded any impressions or input we received from teachers or colleagues that were relevant to student departure, attendance, and program completion. Most of the input that I received came from formal and informal class discussions, as well as from student writings. Luke received input from individual student interviews, feedback from teachers, and from continuing to receive and review student intake and separation data throughout the semester.

Findings

Luke and I both noted that departing students, or students who in some way indicated that they might depart, cited jobs, money, illness, pregnancy, and childcare needs as factors interfering with their studies. At the same time, long-term students explaining classmates' and friends discontinuation of studies, mentioned lack of motivation, low expectations, and academic frustration as factors behind decisions to leave. Typical of the comments we recorded were: " He only came to hang out with his friends," "She didn't have any goals," " He didn't want it," "She didn't think she could pass the GED," "His parents made him come." Teachers stated similar impressions and also voiced frustration that there hadn't seemed to be a way to meet these students' needs. Some of these teachers said that many students' limited frame of knowledge made it difficult for them to form meaningful goals and expectations. Some teachers also questioned whether students who might never pass the GED should be turned toward more attainable goals.

Students who had departed proved difficult to reach by telephone, with no phone number ever having been given, or the number that had been given having been changed or discontinued.

As Luke and I continued to record our observations, Luke created a student retention form. This form made it possible to track students' entries and withdrawals throughout the year, noting up to four different withdrawals and returns. This printed record showed retention and return patterns of over 900 day and evening students, making it possible to gather an impression of a connection between the number of a student's returns and the length of each stay. At this point we observed that returning students usually continue their studies for longer periods of time than they had after their original entry.

I continued to assign writing topics that focused on students' educational experiences and expectations. Students asked to respond to a "Dear Abby" style letter written by a student considering dropping out of high school unanimously argued in favor of completing school. Most of these essays cited greater career choices as the primary reason to graduate from high school.

I then asked students to write an essay explaining some of the factors that might cause students to leave high school before completion. One purpose of this assignment was to determine factors that may have interrupted these students' educations. Students cited boredom, difficulty with studies, and peer pressure as factors motivating their departures.

As a final assignment at the end of the semester, I asked students to write an essay describing why students come to adult education classes, why they leave, and what would be the most important asset for an adult education program or class to offer.

All of the papers that I received in response to this assignment stated that students attend adult education classes to improve their lives. The two most frequently stressed specific motivations were the desire to have more knowledge and the need to improve one's employability.

Students stated in the papers that reasons for leaving included boredom and frustration with difficult material. Many students also mentioned here, as they had in class discussions, that students who left had not had very strong motivation to begin with. The papers that addressed the last question stated that classes and programs that provided frequent opportunity for class discussion would be the most successful.

Near the end of the semester Luke and I designed a focus group of teachers at the Adult Career Development Center. Seven teachers, representing Adult Basic Education, Family Literacy, ESL, and New Student Orientation attended the group. Luke facilitated the group and asked the participants to suggest any factors that seemed connected to student retention. Luke and I videotaped this focus group session.

At the discussion the group stressed several points. One was that students who feel a need for the instruction offered in a program (i.e., ESL students) are likelier to stay until their goals are met. Another point raised and repeated was that students bring expectations into programs and that those expectations are not always met. The third major point on which the group agreed was that students who form a bond with the class or program they are enrolled in are likelier to overcome obstacles to remaining in that program and stay until they have reached their goals. Several participants suggested that that bond can only be meaningfully achieved through initial and continuing dialogue between student and teacher centered around the student's needs, concerns, and goals.

We then conducted individual interviews with other teachers, other school personnel (these included members of the support and security staff), continuing students, and students who had discontinued studies. We videotaped these interviews as well. In these interviews, the themes of obstacles and motivation were repeated, with the recurring theme that adult students face many daunting obstacles and only those with specific goals will summon the energy to overcome those obstacles.

Conclusion

Throughout our discussions (formal and informal), interviews, data review, and in students' essays, we have found the importance of strong motivation springing from concrete, effective, and attainable goals stressed by individual's participation in all areas of Adult Basic Education. While other factors affecting student retention were raised by participants throughout our research, the determining influence of goals was indicated repeatedly and pervasively.

We have observed that individuals with immediate or specific goals tend to remain longer, and complete their studies more frequently. We know that many students do not enter adult education courses with specific goals in mind. Mandated students, in particular, might see little connection between their reason for participating in a program and what is actually offered in that program. We cannot give these students goals, and we cannot instil in them the desire to stay without goals.

It is our conclusion then, that for an adult education program to be effective in retaining its participants, it must from the outset manifest a student centered approach. This approach would consist on every level (intake, orientation, counseling, instruction, and assessment) of eliciting each student's needs through individual discussion, followed by guidance in response to the needs that the student has expressed. We also recommend frequent class discussion to help to inspire goals through the exchange of ideas.

A goal that does not come to life inside the student will not live long within that student. In Adult Education then, it is imperative that we elicit more than we instruct, and that what we offer is in response to what we have been asked.

FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION

Secrets of Retention in Adult Education

Patricia Robbins and Sandra Collier

Acknowledgements

There are many people we must thank for helping us with this project. Thanks to our Regional planner, Rebecca Scott, for having enough faith in us to recommend us for the job of representing our region, for her support, encouragement, and many of our supplies. Thanks to Tommie, Jack, and all our fellow Adult Education instructors who lent us their time and opinions. Our appreciation and admiration go to the students who were willing to share their thoughts and experiences with us so that we could write this paper. A special thanks to our devoted families who sacrificed and buckled down and overlooked our craziness at times. Finally, thank you goes to Sue Cockley for her direction, support, and "real-life" approach to research, and to Joyce Krech for her help in countless ways....

Introduction

As a result of a call from the Virginia Research Network for teachers interested in studying the problems of Adult Education retention, applications were submitted to become part of the Virginia team. The pair of researchers from Southwest Virginia was to be representative of rural adult education programs. The other team members were to represent the state's urban population and the English-as-a-Second Language program.

A similar team was being put together in England. The two teams were to compare the results of their research at the end of the project. This comparison would be done by teleconference.

Adult Education has long been plagued with a large attrition problem. Educators, aware of this, wonder if there are program adjustments or staff training that could help alleviate the drop-out problem. The purpose of this research team was to find out why students drop out of Adult Education programs with less than twelve hours of class time. The hope was that our findings would uncover alterable situations that contribute to student attrition or give light to factors that contribute to student retention.

The Southwest Virginia team chose to compare the student's expectation of adult education to what they found in reality The theory was that the students who got what they expected out of adult education would be the ones who stayed more than twelve hours.

Methods

The researchers agreed on a set of questions to ask during the data collection phase. Personal interviews, telephone interviews, and student surveys were completed. Adult Basic Education teachers, other than the researchers, interviewed some students. Adult Education teachers were also interviewed, both in groups and individually.

We surveyed 43 students with more than twelve hours in an Adult Basic Education class and 15 students with less than 12 hours. We interviewed by phone 13 students with more than 12 hours and reached 27 with less than 12 hours. We had personal interviews with 13 students with more than 12 hours but were were unable to schedule any interviews with students with less than 12 hours.

While we felt that our methods produced a fair sampling of student opinion, we did have a few concerns. Students with less than 12 hours were very difficult to reach. Most were not attending classes. Of the 85 students we attempted to reach by phone 22 phones were disconnected, 27 students were not at home, 5 were wrong numbers, and 4 lines were busy. We also were concerned that the students interviewed by their teacher may not have felt they could be completely open about their dissatisfaction.

Also, parts of the survey were written so that true percentages were difficult to deduce, leaving much up to interpretation. Finally, parts of the survey were confusing and the students may have had a difficult time following the directions.

The attached charts represent our findings:

Figure 1: ABE students' expectations of an Adult Education class compared to the reality of the class
Figure 2: How did the ABE students learn about Adult Education classes?
Figure 3: ABE students' goals
Figure 4: Comparison of teacher and student explanations for dropping out with less than 12 hours

Findings

In reviewing our research, we recognized the following trends:

1. The majority of the ABE students in both groups did not expect the class to be like it was.
2. The students in both groups liked what they found in the class better than what they expected it to be like.
3. The main goal for both groups of ABE students was to get a GED.
4. What students thought were the reasons for dropping out correlated about 80% of the time with what the teachers thought were the reasons for dropping out.
5. 100% of the students interviewed like their class.
6. 85% of the student wrote that their teacher was what they liked about their class.
7. Students who commented on what they liked about their ABE class mentioned their teacher and teacher controlled activities. They liked the individualized attention, friendly atmosphere, and working at their own pace.
8. We found that students with less than 12 hours were difficult to contact. We think the reason for this is that they have financial problems that lead to their phones being disconnected. Also, we feel that disconnected phones indicate that these students may have moved. All students we interviewed with less than 12 hours had personal problems that interfered with making education a priority in their lives at this time. Most of them indicated a desire to return to ABE class as soon as other situations improved.

Using the preceding trends as a basis, we have arrived at the following conclusion:

1. We could find nothing to suggest that students drop out because their expectations were different from what they found in reality in their classes.
2. Teachers and students have similar perceptions of the reasons that contribute to the students dropping out with less than 12 hours of instruction.

Conclusion

While interpreting our findings, we found that we were able to make some assumptions that would need further research if they were to be proven. We feel that it is possible that students with less than 12 hours have set their goal too high. Students functioning on a low level might become frustrated and quit because they realize it will take them years to get a GED. A GED should not be the main goal for every student entering an ABE program. Possibly, the ABE teacher should help each student set more attainable goals. We would like to see further research done on students with less than 12 hours. Data could be collected pertaining to their functioning levels and their commitment to their education as possible reasons for dropping out.

Figure 1: ABE students' expectations of an Adult Education class compared to the reality of the class:

ABE students	Expectations Met Reality	Expectations Did Not Meet Reality
Students w/ > 12 hours	35	60
Students w/ < 12 hours	25	75

Students' expectations:	Reality:
Large class size	Small or medium classes
Class a lot like high school class	Teacher works with small groups
Teacher lecturing to the entire group	Individualized instruction
Everyone working on the same subject and at the same level	Everyone works at their own pace
The class would be too hard	Students like the teacher, other students, and the atmosphere of the class
Reading aloud in class	

Figure 2: How did the ABE students learn about Adult Education Classes?

Referral Source	>12	<12
Friend/Relative	44	29
TV/Radio	12	23
Social Services	26	11
Court Services	0	0
Employer	3	0
Rehabilitation	7	3
Other	8	34

Figure 3: ABE students goals

Goals	>12	<12
GED	70	70
Improve Math, Reading, Etc	20	20
College	29	0
Rehabilitation	3	5
Job	5	5

Figure 4: Comparison of teacher and student explanations for dropping out with less than 12 hours

Reason for dropping out	Students	Teachers
Family problems	x	x
Health problems	x	
Child Care	x	x
Change of Location	x	
Education was not a priority	x	x
Lack of Self-Discipline		x
Transportation		x
Classes do not meet often enough	x	x
Low self esteem	x	x
Embarrassed by failure	x	
Expect too much too soon	x	x

FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION

Bonding and Retention

Sue McGuire

Acknowledgements

I would like to express my great appreciation to the teachers who took time from their very busy schedules to share their ideas with me and to my intermediate class at Dogwood School for sharing their opinions.

Introduction

I teach English-as-a-Second Language in the Fairfax County Public Schools Adult Education Program. Fairfax County offers a wide variety of classes to non-native speakers of English at many locations throughout the county. We offer classes during the day and at night on an intensive (4-5 days/nights per week) and non-intensive (2 days/nights per week) basis. In the fall of 1992, I was offered the opportunity to participate in this project with the Virginia Adult Educators Research Network. For this project, I was part of a two-person team from Fairfax County. In September 1992, my partner and I began our project by travelling to Roanoke, Virginia for a preliminary meeting with other adult education instructors from other parts of the state and with the project coordinator, Sue Cockley. The main purpose of this meeting was for each team to identify their research question. We decided to consider the following:

Is there a relationship between class bonding and retention in the first 12 hours of class?

Methods

The three methods we used to collect data were observations, surveys, and interviews. My observations were of an intermediate level class that met two days a week for two hours each meeting. The observations continued over two terms. The fall term began in September and ran for nine weeks through early December. The winter term began in January and I completed my observations in mid-February. In September, the class was made up of a combination of new students and returning students from the previous year. The teacher was new to all of the students. The class had a membership of 12-15 students in each term. Because we have an open enrollment policy in Fairfax County, we continually had new students coming into the class. We did have some drops within this period. Follow-up was attempted for all of the dropped students, but I was unable to contact two of the students.

Surveys were taken from the same intermediate class mentioned above. Twelve students completed the surveys. I explained the reason for the surveys to the students and asked them to discuss their answers in small groups before answering the questionnaires. I tried to leave the students on their own for the discussions and completing the questionnaires, but I did remain in the room and was available to answer questions. I feel that even though students were not asked to write their names on the surveys, perhaps they were unwilling to say anything negative for fear of offending the instructor (See Survey, Appendix I).

I interviewed five intermediate level teachers of Adult English-as-a-Second Language in Fairfax County. These interviews were done in two separate sessions - one session with three teachers - another session with two teachers. These interviews were tape recorded. Two of these teachers currently teach in nighttime non-intensive programs, while one teaches a daytime intensive class, and the other two teach in both intensive and non-intensive programs.

Findings

The reasons for leaving the class, as given by the students, were as follows:
4 - job related
2 - moved
2 - unknown
1 - entered another educational program

One of these students worked at a local drugstore. She reported that when she asked not to be scheduled on Tuesday and Thursday mornings, her supervisor told her she would be scheduled for less hours. She dropped out. Another student came to class for two sessions because she had been laid off, but then she got another daytime job and dropped out. Two other students had been unemployed, but got daytime jobs.

I was unable to contact two students. Mohammed (1) was a tuition student, but had a high level of skills. He expressed boredom with some discussions, only attended three classes, and I was unable to contact him after that. Mohammed (2) entered the class about half way through the fall term. He also had a high level of oral skills, but poor reading and writing skills. He seemed to be working into the class very well and was an active participant. He pre-registered for the winter term, but did not show up for any classes in winter term. Again, I was unable to contact him.

One student was here on a tourist Visa and wanted to stay on as a full-time student. She entered another program as a full-time student. Her aunt is still attending this class.

Of the students I surveyed, I found the following:

41.6% felt scared or uncomfortable on the first day of class

58.3% felt happy and confident on the first day of class.

25% knew someone else in the class before it began.

75% didn't know anyone in the class before it began.

83.3% liked small group work at first.

16.6% didn't like small group work at first.

100% indicated they felt comfortable in the class at the time of the survey.

100% indicated they liked working in small groups at the time of the survey.

8% indicated they knew the other students by name at the time of the survey.
16.6% indicated they know most of the other students by name at the time of the survey.

58% indicated they know some other students by name at the time of the survey.
16.6% indicated they did not know other students by name.

16.6% said they talk on the phone with or see other students outside of class.

41.6% said they sometimes talk on the phone with or see other students outside of class.
41.6% said they do not talk on the phone with or see other students outside of class.

All of the teachers interviewed said that they thought there was a relationship between bonding and retention, but they also all agreed that bonding was only one factor among many. They listed the following as some of the other reasons students may drop out:

- moving
- poor teaching
- classes not relevant
- too overwhelming
- home responsibilites
- economic pressure
- work

The teachers indicated that they judge the degree of bonding by:

- the way students respond to activities
- the way and the amount that students talk to each other during, before, and after class and during break time
- body language
- the amount that students are willing to help each other
- the degree to which students take responsibility for their own learning - that is the teacher provides the structure and serves as a resource, but the students are able to function without the teacher.

The teachers reported that they use a wide variety of activities to encourage bonding in the first twelve hours. These include:

- many activities to get the students to know names and personal information about other students.
- group activities and a variety of group structures
- games
- requests that students notify teacher or other students of absences
- refreshments at breaks
- parties
- information given to the students concerning what the class will include and what the teacher expects of them

Some teachers indicated that students entering the class late did present a problem to classes that had already bonded. They said that this was more of a problem with intensive classes, because bonding occurred earlier and was perhaps stronger. Other instructors said that if it didn't bother the teacher, then it wouldn't bother the students. All of the teachers did agree, however, that perhaps they needed to take special steps to ensure that new students become a part of the group. They said these steps might include introductions, question and answer periods, and restructuring of groups.

Discussion and Recommendations

Of the dropped students, I felt that bonding might have been a factor in three cases. One of these said that she dropped because of a job, but I felt that bonding never occurred for her. She entered the class late, was very quiet, her attendance was never consistent, and she never really seemed comfortable. The other two were the two Mohammeds that I mentioned earlier, but I was unable to contact them.

From my observations, it appeared to me that the most significant factor to encourage bonding was small group work. Often the small group work was in the form of pair practice or problem solving, but even then students had the opportunity to get to know each other better. As the classes became more comfortable and better acquainted, it seemed that discussion questions were more readily received and the conversation much more lengthy. Toward the end of the observation period, the students seemed to especially enjoy questions that involved comparisons of situations here and in their countries and talking about how issues related to their personal lives. I don't think these discussions would have been possible if some degree of classroom bonding did not exist.

One question that arose several times in discussions with other teachers was why some students (who may have many of the same problems as those students who drop out - such as child care, work, economic, transportation, poor teacher, lack of bonding) just seem to be determined to keep coming to class and learn English? What can we do to encourage this in all students?

Appendix A: Student Survey
Appendix B: Teacher Interview

Dear Students,

I am working on a research project with five other teachers. We want to know why some students stay in school and some students drop out. You are the students who stay in school. Will you help me? Please talk about these questions in groups before you write the answers. Thanks!

Yours,

A. YOUR FIRST WEEK OF CLASS

1. How did you feel about the class on your first day of school?

2. Did you know anyone in the class before it started? How did you know these people? Did you come by yourself to class?

3. Did you enjoy working in small groups at first?

B. YOUR LAST WEEK OF CLASS

1. Tell me how you feel about the class now?

2. Do you know all the students by name? Do you talk on the phone with other class members or see them outside of class?

4. Do you feel differently about working in small groups now?

5. Everybody seems very friendly. What happened in the class to make this friendly feeling?

TEACHER INTERVIEW

Name_____

Date_____

Interviewer_____

By telephone_____ In person_____

Recorded: yes_____/no_____ Cassette #_____

We are working on a research project concerning student retention during the first 12 classroom hours. Our research is qualitative not quantitative. We appreciate the time and thought you give to this interview. Please feel free to express your ideas. We don't expect you to support your responses with hard data. Observations based on your personal teaching experience are most welcome.

1. We have been considering class bonding as one possible factor in student retention. Do you think there's a relationship between bonding and retention? If not, why do you think students drop out in the first 12 hours?

2. What criteria do you use to judge how well a class has bonded?

3. Do you use any special activities, techniques, or strategies to achieve bonding during the first 12 hours?

4. Our classes are open entry/open exit. What effect do new students have on class bonding that has already occurred?

BEST COPY AVAILABLE

FACTORS RELATED TO STUDENT RETENTION IN ADULT EDUCATION

Class Bonding: The Social Dimension

Joan Blankmann

With thanks to: Marie Roberts, Priscilla Kirby, Linda Bolognesi, Mary Ray, and Helen Panitt for sharing their classroom experience.

Introduction

In September 1991, shortly before the Fall Term began, I received a telephone call from the Director of our program asking if I would be interested in participation as a researcher in an international project sponsored by the Virginia Adult Educators Research Network. The topic to be studied was "Essential Elements for Retention During the First 12 Hours of Instruction."

As an Adult ESL teacher for Fairfax County, I had taught different levels of ESL at different locations under different circumstances. I felt that student retention was linked to a commitment and early in the term and that the expectations of the teacher, as expressed in a firm attendance policy, encourage that commitment initially.

I also thought that class solidarity provided motivation and support for continued commitment and attendance. I had observed Beginning level classes at my evening school move together as groups through the next levels. I know that transportation was often shared. Stray members placed elsewhere would fight our system to rejoin their classmates. An afternoon Intermediate class I had recently taught bonded so well that they continued to socialize and network when the class was finished. Over the summer those students who were more established in the US had given practical assistance to their new arrival classmates struggling with everyday problems. Everybody in this group had registered for the next class.

Teamed with another teacher in the Fairfax Adult ESL Program, the first challenge of the project was choosing a research question. Since our research was to be qualitative rather than quantitative, we decided to look at class bonding as it affected retention, a subject that interested my research partner as much as it interested me. Two other teams in Virginia explored their own research questions, and as a group, our findings would be discussed with colleagues in England by means of a teleconference.

Research Question

Is there a relationship between class bonding and retention in the first 12 hours?

Methods

1. Classroom observation of daily Intermediate Adult ESL class meeting Monday - Friday, 12:30 - 2:30 pm, Pimmit Hills Adult Center. Intermediate levels I and II were combined in this class. Journal recorded classroom policies, activities, student interaction, problems, and successes of student bonding, attendance, and retention. Approximately 20 single-space pages including class chart with relevant social factors.

2. Survey of students using attached form. 18 responses. The language level and writing ability of the students presented a problem. In addition, the questions may have been too analytical to use cross-culturally. Relating feelings to events and events to feeling was difficult.

3. Interview of five teachers conducted by telephone, recorded on cassette. See attachments. All salient points were transcribed. Teachers were chosen for years of Adult ESL teaching experience in the Fairfax program (5+) as well as weekly teaching schedule (intensive daytime class plus evening class).

4. Academic notes are included in the journal. Most pertinent are references to the Pima County Adult ESOL Curriculum from Arizona in which retention problems of open entry/open exit classes and the effect of waiting lists on retention are discussed.

Summary of Findings

Out of 41 students enrolled in the observed class during the term, 3 transferred within the first 12 hours: 1 to an Advanced level class and 2 to the morning Intermediate II class. There were 9 drops during the term, but only 1 during the first 12 hours. This student was unable to conform to the announced attendance policy and was not allowed to continue in the class. Three other students were dropped for the same reason. Two students moved form the area. One student obtained a daytime job, dropped for the term, but returned to an evening class the next term. Two students were dropped for medical reasons: one returned to class in the following term, one entered Adult High School, as arranged, after her surgery.

Although officially an open entry/open exit class, this class had a waiting list from the beginning. As a result, an attendance policy was formulated and enforced to weed out those ABE student who were unable or unwilling to attend daily and make room for students on the waiting list. The attendance policy did not apply to the six tuition students or the two students from the Senior Citizen Center. The new strict attendance policy brought to light those students who register for class knowing that they can't come every day, usually because of their job. Since places in class were at a premium, students, including those with previously poor attendance records, were forced to make a commitment in order to retain their place. They were generally scrupulous about reporting/arranging necessary absences in advance, according to the procedures outlined in their Class Information sheet (attached). This provided them with the phone numbers of both teacher and school. Only two students were allowed to enter the class after the first 12 hours. For most of the term, the class was relatively stable in terms of member attendance and retention. All of the core students either registered for the Winter Intermediate class or advanced to another class or education program.

The observed class appeared to bond well during the first week, but received a setback the following Monday when seven new students were introduced. As the class was very large, people bonded in clusters with friends from previous classes. Tension between higher and lower level students was noted. These problems were resolved by open discussion, interactive problem-solving activities, and daily seat rotation, giving students an opportunity to express their feelings/opinions and get to know each other better. The enthusiasm for the Halloween Party, a social event requested by the students, demonstrated the class solidarity that was achieved after the setback.

Although not all the teachers interviewed agreed that there was a strong relationship between bonding and retention, it's interesting to note that all five use activities in the first 12 hours to facilitate bonding. Most common are name games, conversation mixers, varied groups and pairs for class work, and English only during the break so no one is left out. The observed class interviewed each other in pairs and introduced their partner to the class. Listening members filled out a chart which gave them a profile of the class, as well as a class list with phone numbers. Class statistics were compiled as were the results of the Needs Assessment. As one teacher put it, the purpose of these activities is "to give them a sense of each other and who they are as a class."

The teachers could recall classes that had bonded well and classes that had not. Some variables mentioned:

Evening/Daytime - evening classes more difficult to bond than daytime classes. Retention better in the daytime.

Nonintensive/Intensive - nonintensive classes (meet 2x a week or less) more difficult to bond than intensive classes (meet 4x a week or more). Retention better in intensive.

Language level - beginning level more difficult to bond than higher levels.

Class size - larger classes more difficult to bond than smaller classes.

Multilevel/single level - Multilevel more difficult to bond.

The teacher plays an important role in class bonding according to the surveyed students and teachers. Both the teacher's attitude and lesson design can facilitate the process. There is also some indication that the bonding the teacher achieves with the students affects the bonding that the students achieve with each other. However, the social and cultural mix, different for each class, has a bearing as do certain individual students who act as a catalyst to bring everyone together. This could be with humor, enthusiasm, or even sharing a problem.

Three of the teachers interviewed doubted that class bonding occurred within the first 12 hours. The observed class seemed to bond in the first week and was consequently unbalanced by the intrusion of seven new students on the following Monday. The class had no problem absorbing two new students later in the term. Criteria for judging the level of bonding in-class might include student interest and participation in learning activities, their ability to work in different groupings, the freedom they feel to make suggestions, and the degree of socialization during break time. The ease with which a class interacts seems to relate to the bonding it has achieved.

The motivation/goals of a student was seen as a major factor in retention by the five teachers. However, bonding may fortify motivation or even inspire goals. A chain effect was seen with the students in the observed class who went on to Adult High School. Encouraged by her teacher, the first student took the test and was accepted for Adult High School. She in turn inspired another student to do the same who in turn inspired her friend. They all served as role models for a fourth student who was accepted for a later term. The three students whose only language in common is English continued to be mutually supportive in their new academic endeavor.

Students with uneven skills - strong verbal but low literacy - and students with only a few years of formal education were considered more likely to drop out. However, that was not the case with the observed class. Again, those were the students who felt encouraged to continue their education in the Adult High School program. Correct placement was cited as a factor in retention at the Advanced level since these students often have a specific goal that they are pursuing. Job interference, weather, transportation, and other external factors (some never known to the teacher) were the reasons most often given for dropping out at the Beginning and Intermediate levels.

It was not always easy in the observed class to discover how much help students received from their classmates in resolving external problems. Some students were noticed to be commuting together regularly; others seemed to help out with rides when the need arose. I discovered by accident that one student had been extremely upset by an encounter with an enraged policeman. She eventually went to traffic court and won her case. In this instance, the teacher was not part of her support system. She looked to her peer group, members of the class, for comfort and advice.

Interpretation and Suggestions

A waiting list and concomitant attendance policy improves retention. Stability in class membership is a reinforcing factor. An open entry/open exit policy may defeat its own purpose by promoting poor attendance/retention rather than encouraging it. Suggestions for Practice: walk-in hours, workshops, self-help clinics, short-term classes to accommodate students who cannot make a long-term commitment, fewer classes with tight attendance policies for long-term students, study contracts at registration.

Class bonding is one factor in retention. It could be particularly relevant for students who are easily discouraged by learning difficulties and/or life problems. Suggestions for Practice: peer tutoring, peer counseling, follow-up phone calls to dropouts by peers, interactive/cooperative learning to foster and maintain class bonding.

Suggestions for Further Research

Expectations of teacher regarding attendance and retention: Are attendance and retention matters of concern to the teacher? Does he/she expect students to act in a responsible and considerate manner regarding their attendance? Does he/she discuss the importance of attendance and retention to the student (learning continuity, goal realization), to the other students (class solidarity, role model), and to the teacher (lesson planning, administrative work, feedback). Has the teacher formulated an attendance policy and procedures for calling-in absences/dropping the class/transferring? Do the students have this in writing with phone numbers at the beginning of their course of study? Has the class developed a class list with phone numbers so they can contact each other when necessary?

Essential elements of class bonding: What does social science research tell us about small group cohesion? What are the characteristics of high and low-cohesion groups? What are the principles for building group cohesion? Are these principles employed in professional sectors? How can these principles be applied in the classroom to develop good bonding? Do some teachers instinctively use these principles? Do these teachers retain students better?

Attachments:

Model 1: Traffic in ABE/ESL Class
Model 2: Green Light for ABE/ESL Student

Appendix A: Class Information Sheet
Appendix B: Student Survey
Appendix C: Teacher Interview

Traffic in ABE/ESL Classes

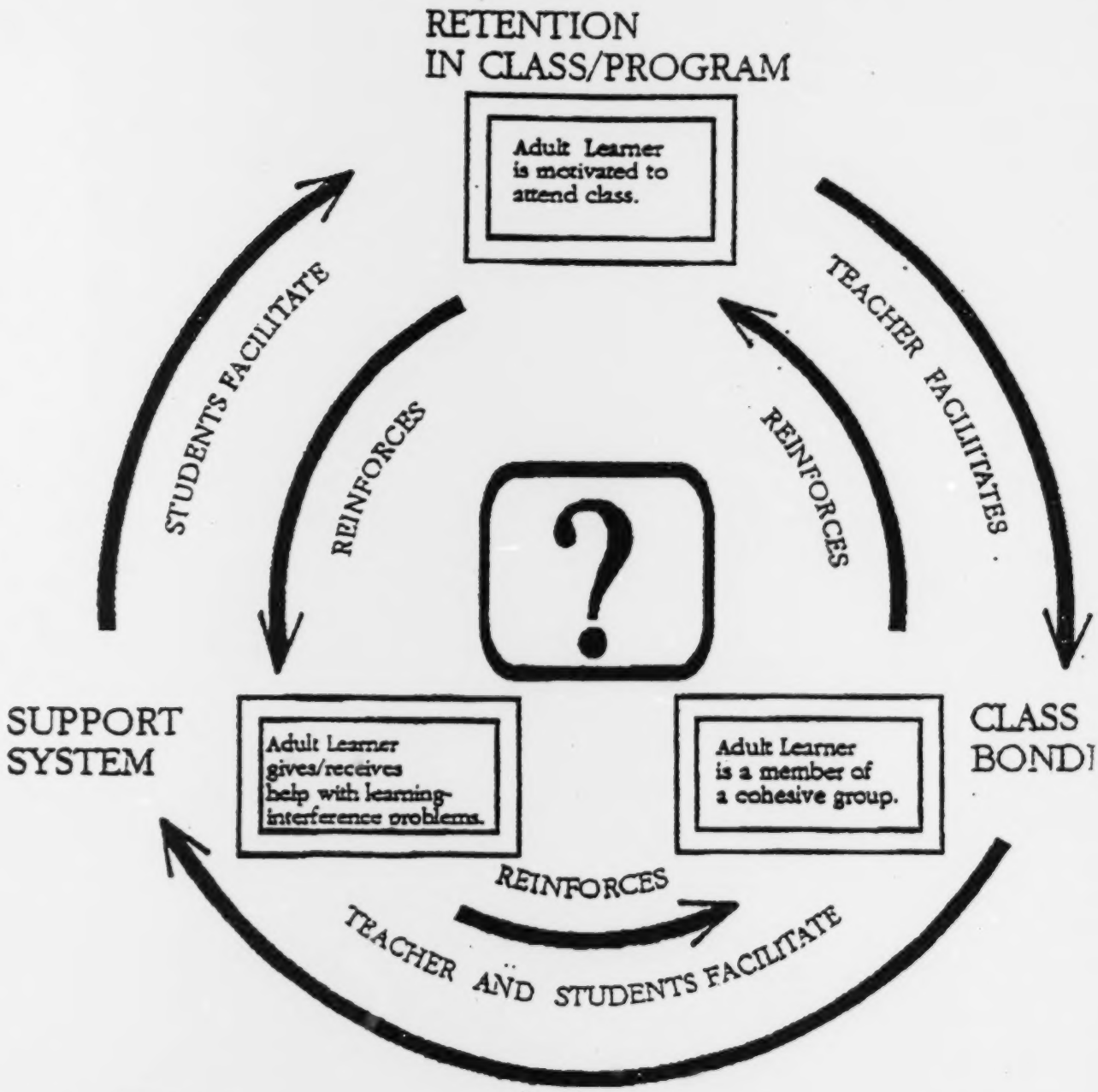
STOP
STUDENT DROPS OUT IN FIRST TWELVE HOURS.
CAUTION
STUDENT'S ATTENDANCE IS POOR. DROPS OUT LATER IN TERM.
GO
STUDENT IS MOTIVATED TO COMPLETE CLASS/ PROGRAM.

MODEL 1

CREATED BY JOAN F. BLANKMANN
5951 QUEENSTON ST., SPRINGFIELD VA 22152
(703) 451-9182

GRAPHICS BY DRAWING B., 1234 5TH AVE., BROOKLYN NY 11215

GO: GREEN LIGHT FOR ABE/ESL STUDENT
THE SOCIAL DIMENSION



MODEL 2

RESEARCHED AND CREATED BY JOAN F. BLANKMANN
5951 QUEENSTON ST., SPRINGFIELD, VA 22152 (703) 451-9182

GRAPHICS BY DEARING B., 123A 8TH AVE., BROOKLYN, NY 11215

PIMMIT HILLS ADULT CENTER
Phone Number: (703) 506-2257
Intermediate English: Fall Term 1992
Teacher: Joan Blankmann
Phone Number: (703) 451-9182

1. CLASS DATES
Begin: Monday, September 28. End: Wednesday, December 2.
No School: Monday, October 12 (Columbus Day)
Thursday, Friday, November 25,26 (Thanksgiving)

2. ATTENDANCE
This class meets five days a week from 12:30p.m. to 2:30p.m. If you cannot come every day, please talk to me about registering for a two-day class or taking the class at some other time. There is a waiting list for this class. After 5 absences students are dropped so a new student can take the class.

You need to tell me if you are going to miss a class. If you are sick or have a problem, please call the Pimmit office or call me at home. You also need to talk to me if you want to drop the class or transfer to another class.

A class is like a family. We will all ask, "Where's _____?" if we don't know why you have stopped coming to English class.

3. PUNCTUALITY
Class starts at 12:30p.m. Class does not start at 12:40 or 12:50. Please be on time.

4. SCHOOL RULE
No smoking in the building.

5. CLASS RULE
ENGLISH ONLY IN THE CLASSROOM!

6. BREAK
10 minutes: 1:30p.m. to 1:40p.m. ENGLISH ONLY!

We can make tea and coffee in the classroom. Each student should bring a cup to school and put it on the shelf. You could also write your name on a paper cup and keep it on the shelf.

We need a student volunteer to collect money and go shopping.

We need another student to take out our coffee/tea box everyday and put it away at the end of class.

7. TEXTBOOKS (2)
Problem Solving: $12.00

Beyond the Classroom: $14.00

Dear Students,

I am working on a research project with five other teachers. We want to know why some students stay in school and some students drop out. You are the students who stay in school. Will you help me? Please talk about these questions in groups before you write the answers. Thanks!

Yours,

Joan

A. YOUR FIRST WEEK OF CLASS

1. How did you feel about the class on your first day of school?

2. Did you know anyone in the class before it started? How did you know these people? Did you come by yourself to class?

3. Did you enjoy working in small groups at first?

B. YOUR LAST WEEK OF CLASS

1. Tell me how you feel about the class now?

2. Do you know all the students by name? Do you talk on the phone with other class members or see them outside of class?

4. Do you feel differently about working in small groups now?

5. Everybody seems very friendly. What happened in the class to make this friendly feeling?

Created by
Joan Blankmann

Date:

Dear _____:

I am working on a research project concerning student retention during the first 12 classroom hours. We are considering class bonding as a possible factor. Since our research is qualitative, not quantitative, your views as an experienced Adult ESL teacher would contribute to our research.

I would like to interview you in person or by phone on this subject. The interview will take about 15 to 30 minutes and will be recorded for research purposes only. Please note below your interview preference and the best time for you to be interviewed. Place in my mailbox. I will try to coordinate my schedule with yours.

Your contribution to this research is greatly appreciated.

Yours truly,

Name _____Telephone #_____

I prefer to be interviewed : IN PERSON_____BY PHONE_____

Best day and time : _____

Created by
Joan Blankmeyer

WHY DO WELL-PREPARED LEARNERS DELAY TAKING THE GED TEST?

A Study of Test Anxiety Among Adult Education Students

Barbara Guthrie

Selecting the Topic and Methods Used

During the past five years of teaching adults, I have encountered the situation of well-prepared learners delaying taking the GED. I began to wonder why they would hesitate taking the test, if other teachers had the same problem and what could be done to encourage these learners. More than one of my students had postponed the test for over a year. In fact, last June as a worksite class most of the students had scored in the range of the 220's on the practice GED. To my surprise, everyone returned in September. No one took the GED test during the summer.

To investigate the questions I had, I used the Virginia Polytechnic Institute and State University's Newman Library. A survey of over 100 teachers by questionnaires was sent through the mail. In addition, I interviewed ten teachers in person, six from the New River Valley and four from David, Kentucky. Observations of my learners were recorded.

Related Literature References

There are 358 pieces of information on test anxiety according to the ERIC search I conducted at Virginia Polytechnic Institute and State University. However, test anxiety information related to the GED test or adult education is scarce. I also searched through the PsyLit system. Most of the literature is psychological data from research papers and journals. From my experience teaching adults and a recent teacher survey I conducted, there are many reasons why learners delay taking the GED test. Much of the literature I have cited can be applied to the GED student.

Many of our GED test-delaying learners have characteristics of three categories of behavior. Probably you will recognize these tendencies in your students or even yourself. They are: fearers of failure, the success-fearing personalities, and procrastination. I began by researching the topics of fear and test anxiety. The following passages shed some insight on this subject.

Fear of Failure

"FEAR - False Expectations Appearing Real" (Roger, p 33)

"Almost all excuses and reasons are motivated by fear - fear of fatigue, fear of not doing it perfect, fear of looking foolish, fear of mistakes, fear of losing, fear of being let down, fear of failure, and fear of unworthiness." (Roger, p 291)

"The first decision a person must make when faced with an achievement situation is whether or not to become involved at all (oriented to avoid failure). Since he cannot fail if he doesn't take part, he will avoid whenever he can.

Not trying serves two functions in regard to failure-fearers: 1) it reduces the significance of the actual performance as an indicator of the underlying skill thereby avoiding any implications for lowering self-estimate and 2) it argues that the task and the relevant skills are really not important and thus the loss of self-estimate is of little concern." (Heckhausen)

"There are large segments of our society that avoid achievement situations whenever they can and when they cannot, do not try to succeed. Persons fearful of failure may simply be fearful of losing value in the eyes of others...many people 'running scared' and knocking down one success after another with the prime motive of avoiding those terrifying moments of failure.

High test anxious individual - to avoid a situation - choose goals in a way that contributes to their problems. They select very easy or very difficult tasks. They attribute success to the task or luck. High fear of failure subjects generally regard effort and persistence as ineffective. They often reduce their expectations and thus insure a mediocre performance.

If a person believes he has a very small chance of attaining the standard he may reduce the cost of the effort and time by not trying...by not attaining the prescribed standard he doesn't receive any rewards and takes the chance of losing social value...whether he tries or not depends on which kind of failure he fears most." (Birney, p 19)

"The student who responds to demands as if they were threats is more likely to be concerned about his performance, anticipates failure, feels incompetent, and considers himself under scrutinizing. He attributes expected failures to his own lack of ability. ...test anxiety specifically can be viewed as an anticipation of failure and as a threat to the self...learned helplessness can be seen as an extreme case of this condition.

When first confronted with academic demands, a person might react positively by exerting effort - after repeated failures and eventual attributions of these failure to lack of ability, the demands become more and more threatening thus very likely resulting in text anxiety. After a certain time a person begins to predict failure. When one 'knows he will fail' he loses all sense of control which ultimately leads to a state of helplessness and self-degradation." (Schwarzer, p 36-37)

"High test anxious subjects tend to make self-devaluation statements (i.e., 'my mind is blank,' 'I really feel stupid') particularly if being observed during a performance." (Granger)

I have observed this phenomenon with my students. While taking tests such as the TABE and practice GED, many negative remarks are made by high test anxious students. Please see the section on observations for more detail.

"Not only do low creative individuals make negative self-statements while attempting to solve problems, but they are more debilitating on performance following such statements." (Granger, p 194-199)

"If a fear of failure predominates (he will)...recoil from competition and withdraw from risks and attempts that might be viewed as pathetic attempts as self-betterment. If a person is sufficiently stressed about the occurrence of a good outcome...s(he) experiences an impulse to disengage from the dimension under consideration or the withdrawal from a goal that has been adopted. In some cases this impulse is expressed overtly, as a withdrawal of effort or literally leaving the field. The person becomes mired in distress." (Carver)

"Fearers of failure are simply less concerned about raising self-evaluation and more concerned about it being lowered. The best way to protect what one believes is not to have it tested. The fear of failure person is often described as achievement avoidant. One way is not to participate in the achievement situation. Given an opportunity to quit

an activity that entails an evaluation of his performance for some other kind of activity, he is quick to take it." (Atkinson p 269-370)

"The level of anxiety is symptomatic of the degree of resistance to an activity." (Birney)

"Fear will increase with:
a) heightened personal importance of success or failure.
b) raised level of aspiration
c) lowered estimate of competence
d) increased estimate of probability of failure
e) proximity of the exam.
(Becker)

"What will the fearers of failure do when constrained in an achievement situation? Even though he has been constrained by some threat, he can still essentially avoid failure by not trying." (Birney)

"People preparing themselves for an important examination are more worried, tense, and easily irritable. Examinations, exam stress, and evaluation situations can arouse anger. If the subject experiences a loss of perceived control flight tendencies may result and fear reactions can be observed." (Kleber)

"Finally, the maladaptive responder may avoid the very situation that would yield evidence of competence. Since failure signifies a lack of ability to the maladaptive responder, it implies further effort would not be worthwhile (even risky). Such avoidance might take the form of simply giving up or devaluing the task." (Heckhausen)

Success-Fearing

The second group, the success-fearing personality, has much in common with the fearers of failure. It is summed up quite poetically in The Fear of Failure: "Success involves risk and it is the thorn that keeps fearers of failure from the sweet smell of success."

"A Success-fearer - one who suffers from an inhibition of self-promoting behavior due to an unconscious equation of achievement and competence with aggressiveness/ exhibitionistic impulses - such persons defensively withdraw from full involvement in goal-oriented activities. They are unable to commit themselves to a particular course of action." (Birney)

This kind of thinking is particularly prevalent among my Appalachian learners. Success can have many implications for change in one's life.

"The type of learning which forces us to modify motivation and goals tends to isolate us from those with whom we previously shared so much. Losing one's sense of belonging can be a painful experience as in 'I'm slowly stripped of my sense of belonging.' As our most basic needs and wants are met so we become open to reorientation in terms of goals beyond ourselves...he lives in a society which is suspicious of individuals who change goals and directions." (More)

"Success fearers remain in areas of competitiveness characterized by ambivalence and vacillate from excellent to terrible. Like failure fearers they are likely to belittle themselves by holding low opinions of themselves and their abilities. They also attribute

progress to luck and do as well on the average then would be predicted from a realistic assessment of their potential. Motives are to avoid failure, to achieve success and avoid success.

These are the students that will sabotage their success. They will fall asleep, forget to set the alarm, and decide to withdraw. Self-sabotage behavior happens when a person is near mastering a task or delaying completion of a mastery unit. The ultimate self-sabotage is dropping out." (Canavan)

"You may also fear success because you anticipate that people will make greater demands on you. Because you are convinced you must and can't meet their expectations, success would put you into a dangerous and impossible situation. Therefore, you try to maintain control by avoiding any commitment or involvement. If you don't make any effort, you can't goof up!" (Burns in Roger, p 90-91)

Procrastination

"Procrastination is the fear of success. People procrastinate because they are afraid of the success that they know will result if they move ahead now. Because success is heavy and carries a responsibility with it, it is much easier to procrastinate and live on the 'someday I'll' philosophy." (Waitley in Roger, p 226)

"A procrastinator is someone who knows what (s)he wants to do, is equipped to perform the task he is trying, and planning to perform the task but does not complete the task, is trying or excessively delays performing the task. Often procrastinators keep themselves ready to work (e.g., have the material prepared, etc.) but end up avoiding the activity." (Covington, p 108)

"By not trying, distress at failure can be minimized because alternative explanations such as inadequate efforts are sufficient to explain failure. An everyday example is the procrastinator who may try hard but does so under such self-handicapping conditions such as last minute study that he can be scarcely blamed for ensuing failure and should he succeed the procrastinator will appear brilliant by reason of accomplishing so much with so little effort.

There is a correlation between procrastination over test preparation and tension, worry, and irrelevant thinking." (Covington)

Irrelevant thinking could be considered as irrational thinking.

"Examples of irrational thinking:
1. I must be very competent, if not I'm worthless as an individual.
2. You must treat me fair and righteous else you deserve condemnation.
3. My life situations must be good and easy or else life is terrible and I cannot stand that." (Silver and Sabini)

Encouraging the Learner

There are many good inspirational "sound bites" that can be used as a springboard for a discussion with the reluctant test taker. In John Roger's Life 101, there are several encouraging passages that could be used to motivate a learner. He quotes John Keats: "In Endymion, I leaped headlong into the sea and thereby have become better acquainted with the sounding, the quick sand and the rocks, than if I had stayed upon the green shore and piped a silly pipe and took tea and comfortable advice."

"Give yourself as many retakes as you need. Stars do it."

"Do not look where you fall, but where you slipped." (African Proverb)

"Mistakes are a natural part of the learning process. To avoid situations in which you might make a mistake may be the biggest mistake of all."

"When we do something new, something different, we push against the parameters of our comfort zone...when it expands in one area, it expands in other areas as well. When we give in to our comfort zone the zone contracts. Our belief that you're 'not strong enough,' 'can't do it' and basically 'not good enough' often prevents us from even thinking about approaching 'the zone' again for some time." (Roger)

"The most important function of education at any level is to develop the personality of the individual and significance of this life to himself and others. This is the basic architecture of life, the rest is ornamentation and decoration of the structure." (Kirk)

"Aim for success, not perfection. Never give up your right to be wrong, because then you will lose the ability to learn new things and move forward with your life. Remember fear always lurks behind perfection. Confronting your fears and allowing yourself the right to be human can paradoxically make you happier and more productive people." (Burns in Roger, p 160)

The Teacher Survey

A survey was drafted and revised with the advice of Dr. Foucar-Szocki. Unfortunately, we did not have the survey signed or coded. One hundred teachers were selected from the Virginia Association of Continuing Education 1991-92 Directory. Only those that were teachers, not administrators, were selected. Six teacher/administrators from my locality were interviewed in person. Also four GED/ABE teachers form David, Kentucky were surveyed. Their responses were included in the general survey because there was no variance. The total response was 58 teachers with 5 indicating that this survey did not apply to them.

The following information was obtained: **Which of the following indicators do you use to identify students who are prepared to take the GED?** The practice GED test was used the most often (44%) followed by teacher assessment (43%) and the TABE test (24%). Self-assessment through individually chosen practice tests from books and computers were also used. One teacher mentioned how the student felt about previous GED test scores was a consideration.

What did you do to encourage these learners to take the GED? Many teachers had former learners visit their class to describe the GED test experience and to allow the students to question them. Some teachers suggested that videos with test taking tips are available at local libraries and can be borrowed free by the learner. Teacher counseling one-on-one encourages reluctant test takers. The teacher can reassure the student by explaining scoring. Another hint for encouraging students was advising them of the availability of special arrangements such as the large print test. Finally, it was suggested that teachers should let the student know that it is okay if they do not pass the test.

What percent of your learners each year take the GED test before you feel they are ready? Many teachers indicated that this was of greater importance than the test delayers. Of the 29 teachers responding to this question, the mode was in the 15-20% range, the same percentage as the delayers.

Observations

I have been quite pleased to find many of the literary references can be applied to observations of my students. The literary citations have alerted me to being more sensitive to the needs of my adult learners. I would like to describe three learners that delayed taking the GED test when they were prepared. Their names have been changed.

Wendy was a 36 year old homemaker, mother of four, and a sixth grade drop out. She was the first GED student in our program five years ago. For several months she was the only student. She tested at the sixth grade level on the TABE. Wendy was very willing to learn and progressed rapidly until another student entered the program. He began class at the twelfth grade level. Wendy resented sharing the attention and became very competitive. She started setting unrealistic goals so she could keep up with the new student. As she approached the range in which she could attain a GED, her attendance began to fail. She finally dropped out for five months. Then she returned one night to tell us she studied on her own and received her GED. When questioned as to why she dropped out, we were shocked by her answer. Wendy said she had been institutionalized for attempting suicide; although she had many other problems in her life, she did admit that test anxiety was one contributing factor.

Ray is 64. He is retired from the military with a hearing disability. Upon his entry into my class two years ago he was scoring in the range to pass the GED. He also enrolled in three other classes. Last spring his daughter came to class. My strategy was to get both of them to take the GED so they could graduate at the same time. When the daughter scored 2 points higher than Ray on the practice test, he decided he wasn't ready. Other excuses he gave for not taking the test included no babysitter for the grandchildren, church activities, too much going on, maybe next fall, etc. His daughter took the GED test in early summer and passed. By the next fall, Ray had enrolled in two additional GED classes in areas 30 miles away. Finally, one of his many other teachers counseled him one-on-one. She found the "real reason" he was delaying the test. Ray felt his disability check would be stopped if he obtained the GED. Once he was assured that wouldn't happen, he took the test and passed. He is now employed as my teacher's aide. Recently he told me he'd like to retake the GED to improve his score.

Larry is a 33 year old textile worker and father of four with a tenth grade education. He has been a real challenge to work with. He takes several smoking breaks each class period and is difficult to keep on task. He uses 15 to 30 minutes to begin working. Part of his delaying the test is connected with the fact that he gets out of two hours of his job for his worksite class. If he passes he must quit the class. As of this writing he is waiting for his test scores. This is the first time he has taken the test in ten years. I am suspicious that he might have sabotaged part of the test to stay in class. He often makes self-degrading remarks while being evaluated. "How bad did I flunk it?" "I'm blowing this all to pieces." "It's not my fault." "I have to read everything twice." "I'm under stress." "I screwed this up bad."

Conclusions and Future Project Possibilities

There are many reasons that cause delaying taking the GED. Fear of both failure and success seems to be the most dominant reason. Observing the learner for signals and signs can help the teacher understand why there is a delay and how to manage this behavior. I should have approached Ray long before he confessed his fear of his disability check being stopped. It is obvious that his need to be in so many classes simultaneously should have been a red flag that warned of his need for perfection. In his case as with others there was a combination of reasons. Wendy was so frustrated and competitive that she tried the ultimate avoidant behavior - suicide. I should have been more diligent in finding out why she dropped out, but being inexperienced at the time in working with adults, I was more afraid of being too pushy. It never occurred to me that she was so depressed. Larry, who has deliberately delayed taking the test, says he likes coming to class. I hope he has passed all sections of the test, but it won't surprise me if he didn't just so he can stay a little longer.

Experts in test anxiety suggest five methods for reducing this fear:

"1. systematic desensitization
2. self-controlled relaxation
3. cognitive restructuring
4. participant modeling
5. study skills training" (Ploeg, v 1)

There is little doubt that there should be additional research in this area. I feel that teachers need to become better trained and more sensitive to the real reasons for delaying and dropping out of GED programs. Should a visiting counselor be employed to help recognize serous psychological problems? Would other programs such as the External Diploma be more suitable for highly test anxious individuals? Can additional components be part of the GED in jails and worksites so that when one passes the test they aren't automatically eliminated from the class? A class examination of adult students' self-esteem would be a possible future project. Perfectionism also needs to be studied in depth. If a person can't perform to their own imaginary standards of perfection, they "take their ball and go home. Have no fear of perfection - you'll never reach it." (Dali in Roger, p 70)

How much do the statistics of test anxiety correlate to the GED learner? Most of the research on adults and test anxiety was done on adult groups such as college freshmen, military personnel, etc. I feel the correlation is very strong but further investigations should be undertaken with GED candidates.

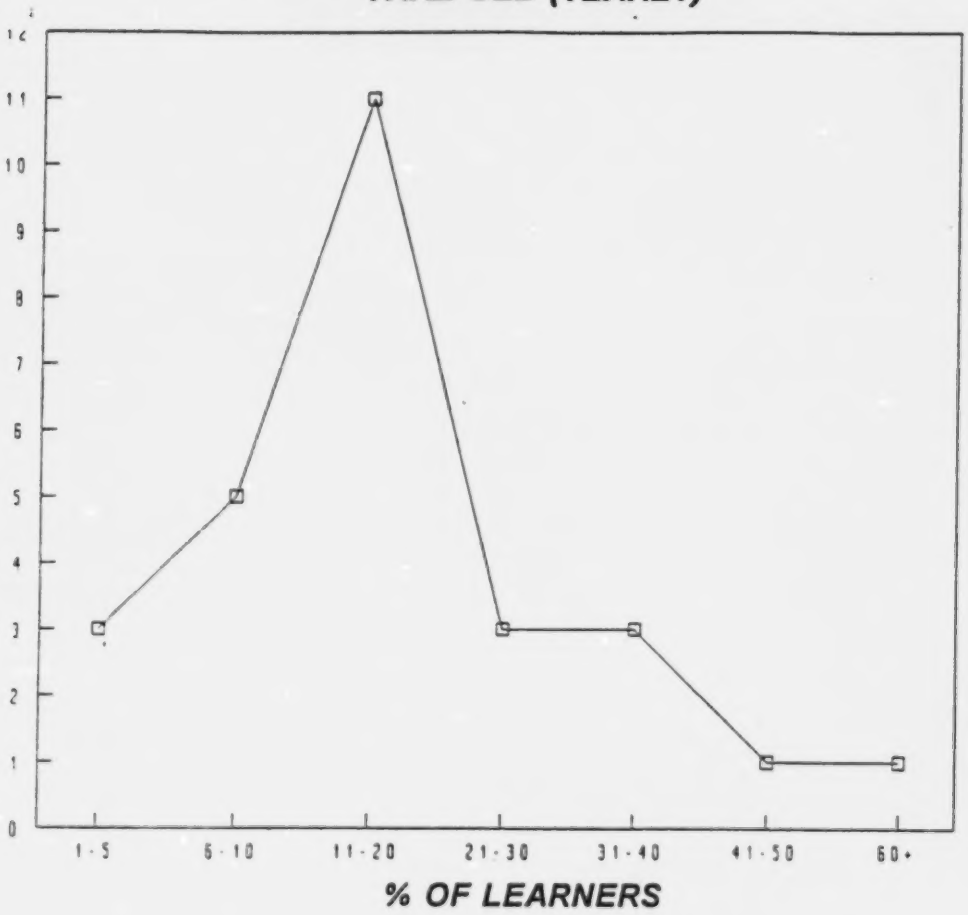
I wish to thank the teachers that participated in the survey; Linda Mullins, regional specialist; Ann Scalon of typing the survey and especially Dr Diane Foucar-Szocki for her advice and the funding from the Adult Educators Research Network. I am grateful to Alicia Poindexter for designing the graphics.

Attachments:

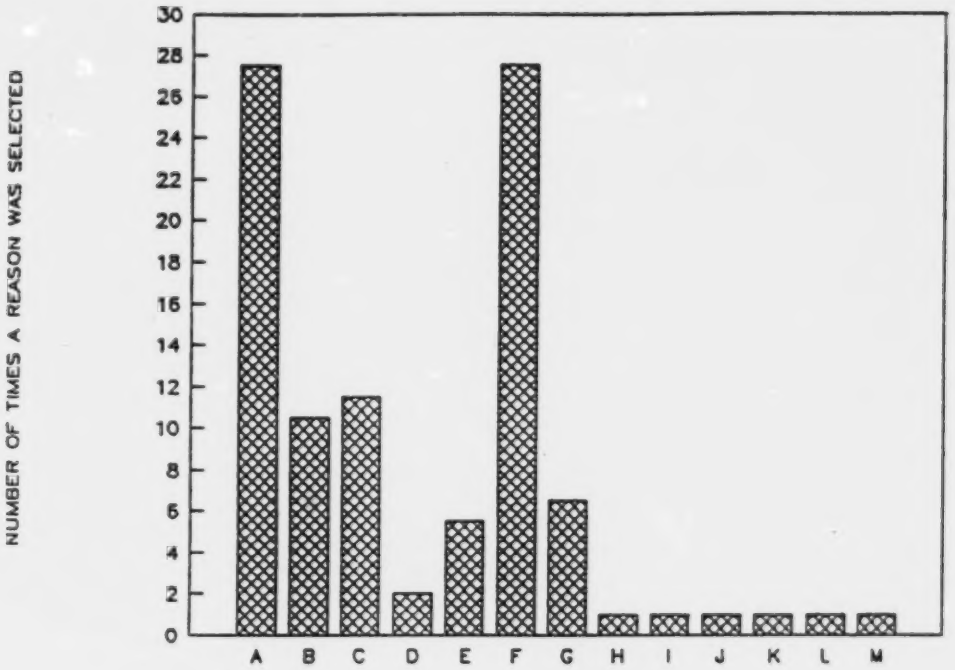
Figure 1: Well-Prepared Learners Reluctant to Take the GED
Figure 2: Reasons Given by Learners to Delay Test
Figure 3: Percentage of Students that Told the Real Reasons for Delaying
Figure 4: Reasons Teachers Believe Learners Delay

Appendix A: Educators' Survey
Appendix B: Self-regulation Flow chart

WELL-PREPARED LEARNERS RELUCTANT TO TAKE GED (YEARLY)

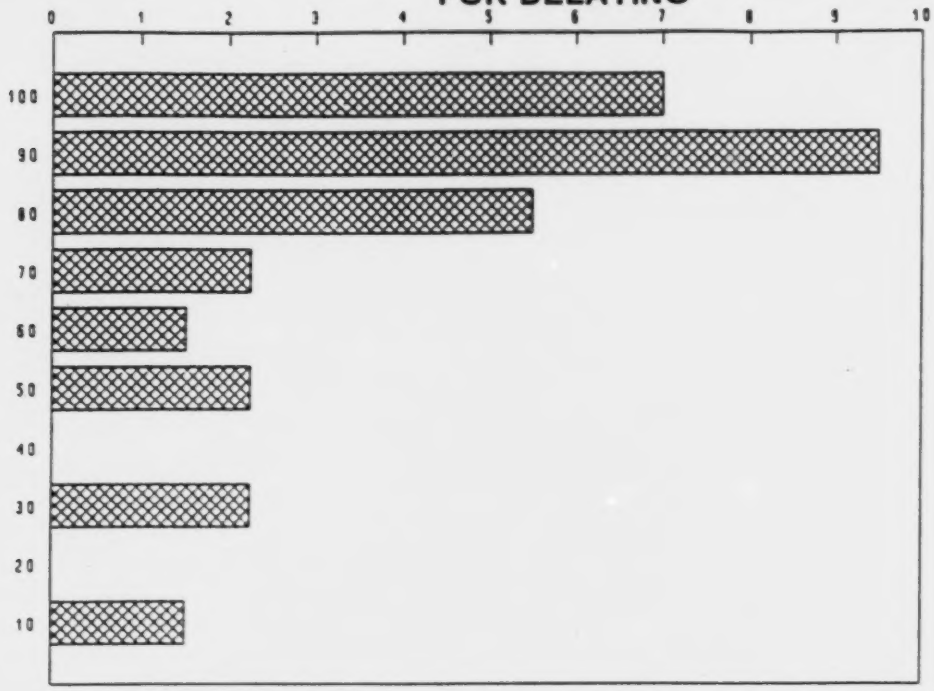


REASONS GIVEN BY LEARNERS TO DELAY TEST



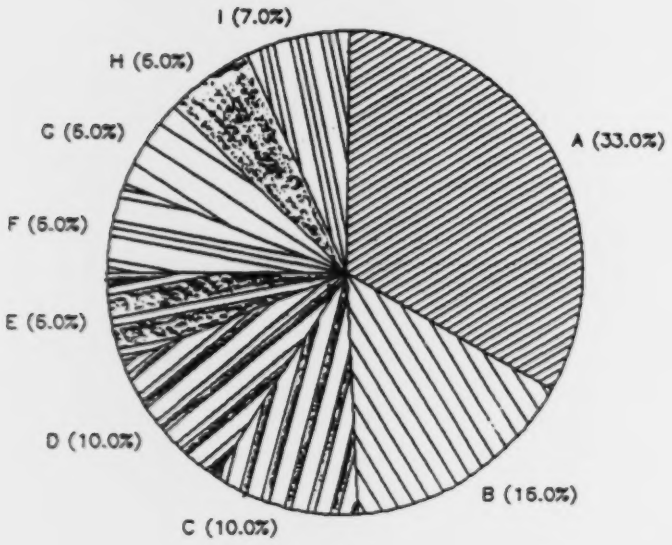
Reasons	Per cent
A Don't feel ready	27.5
B Family problems	10.5
C Lack of money	11.5
D Transportation	2.0
E Childcare	5.5
F Fear of failure	27.5
G Removal	6.5
H Test anxiety	1.0
I Lack of confidence	1.0
J Perfect score	1.0
K Loss of benefits	1.0
L Lack of family support	1.0
M Repeating test	1.0

PERCENTAGE OF STUDENTS THAT TOLD THE REAL REASONS FOR DELAYING



REASONS TEACHERS BELIEVE LEARNERS DELAY

THE G.E.D. TEST



LEGEND:

A= FEAR OF FAILURE
B=LACK OF FAMILY SUPPORT
C= REMOVAL
D= LACK OF CONFIDENCE
E= FEAR OF CHANGE
F=LACK OF MONEY
G= LOSS OF BENEFITS
H= BEING LABLED DUMB
I= PRESSURE OF TIMED TEST
DIDN'T KNOW STRANGERS AT TEST SITE
RELUCTANCE TO JOIN WORKFORCE

February 10, 1993

Dear Fellow Educator:

I am researching a few questions dealing with adult education. I am specifically interested in students who are prepared to take the G.E.D. but make excuses to delay taking the test. I would appreciate it if you would scan your memory for learners you have worked with who were prepared but reluctant to take the G.E.D. exam. With these learners in mind, please answer the following survey questions:

1. Which of the following indicators do you use to identify students who are prepared to take the G.E.D.? (circle as many as apply)

   (a) T.A.B.E. scores (b) practice G.E.D. (c) teacher assessment (d) other (please explain)

2. In your experience, what percent of your well-prepared students each year are reluctant to take the G.E.D.?

3. Please check the reasons given by learners for delaying to take the test:
   Students don't feel ready _____
   Family problems _____
   Lack of money _____
   Lack of transportation _____
   Childcare problems _____
   Fear of failure _____
   Fear of removal from class _____
   Other, please comment _____

4. What did you do to encourage these learners to take the G.E.D.?

5. While we trust that the learners were sincere, what percentage of these learners do you believe told you the real reason for their delay?
   __10% __20% __30% __40% __50% __60% __70% __80% __90% __100%

6. For those learners who did not tell you the real reason for their delay, what do you believe the real reason might have been?

7. Finally, considering another issue altogether, what percent of your learners each year take the G.E.D. test before you feel they are ready?

Thank you for your time. Please return this survey in the enclosed envelope as soon as possible. I am anxious to see your comments. I will be presenting the results of this study at the VAILL conference in July. You may also obtain the results by contacting the Virginia Adult Educators Research Network or by contacting me personally. Thank you.

Sincerely,

Barbara Guthrie

Barbara Guthrie
Adult Educator

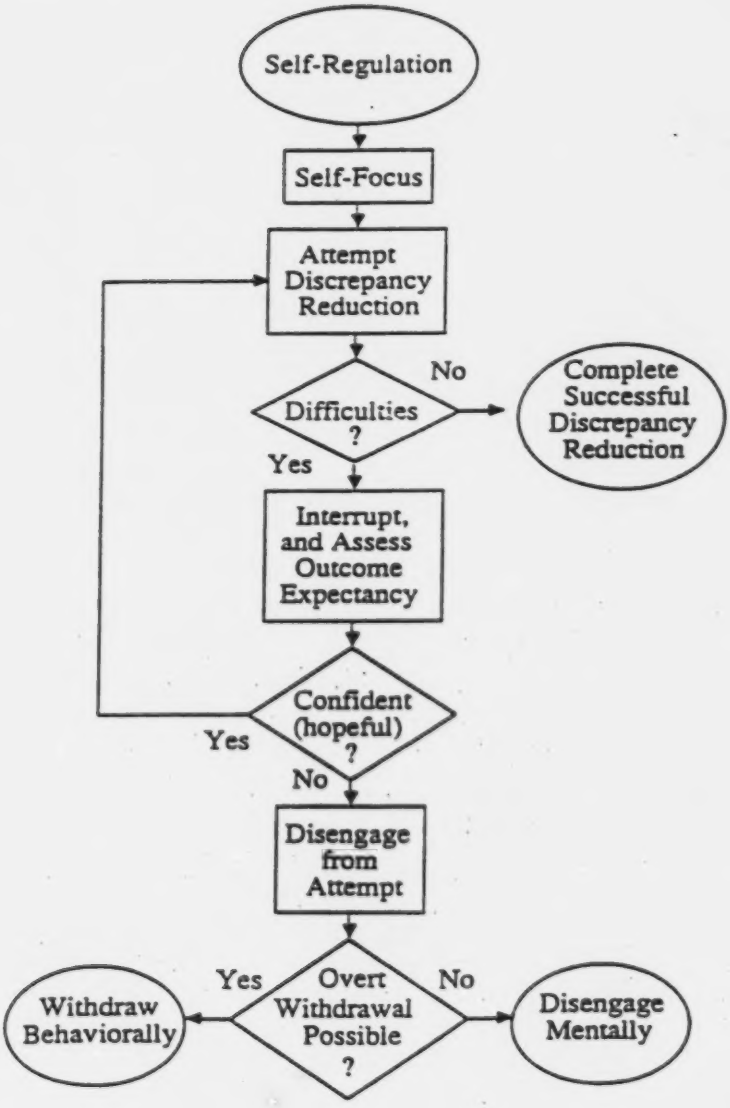


Figure 1. Flow-chart depiction of self-regulatory possibilities when a person is task engaged, including unimpeded goal attainment, interruption and expextancy assessment, and either renewed efforts or disengagement from effort (including the possibility of mental or psychological disengagement.

Bibliography

Atkinson and Feather. A Theory of Motivation. Princeton NJ: Van Nostrand. 1966.

Becke, P. "Test Anxiety, Examination of Stress and Achievement Methodological Remarks and Some Results of a Longitudinal Study." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 2. 1983.

Birney, D., Burdick, H., and Teevan R.C. Fear of Failure. Princeton NJ: Van Nostrand. 1969.

Canavan, D. Gampert. The Success Fearing Personality. Lexington, MA. D.C. Heath and Company. 1978.

Carver, C.S. and Schevir, M.F. "Expectancies and Coping: From Test Anxiety to Pessimism." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 2. 1983.

Covington, M.V. "Anxiety, Task Difficulty and Childhood Problem Solving. A Self-Worth Interpretation." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 2. 1983.

Ganger. Journal of Personality and Social Psychology. Vol 8. 1968.

Heckhausen, H. "Motivations and Emotions." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 1. 1982.

Kalechastein, P., et al. "Procrastination Over Test Preparation and Test Anxiety." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 6. 1989.

Lesse, Swets and Ztillenger, Becker P. "Fear Reactions and Achievement Behavior of Students Approaching an Examination." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 1. 1982.

More, W. S. Emotions and Adult Learning. Lexington MA: Lexington Books. 1974.

Ploegg, H.M. "Test Anxiety and Anger: Some Empirical Considerations." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 2. 1983.

Roger, J. and McWilliams, P. Do It!. Los Angeles: Prelude Press. 1991.

Roger, J. and McWilliams, P. Life 101. Los Angeles: Prelude Press. 1990.

Schwarzer, R. and Jerusalem. M. "Self Related and Situation Related Cognition in Test Anxiety and Helplessness. A Longitudinal Analysis with Structural Equations." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 2. 1983.

Silver and Sabini. "Procrastination Over Test Preparation and Test Anxiety." in Schwarzer, R. et al. Advances in Test Anxiety Research. Vol 3.

Thomas, Yoselaff. Anxiety and Education. New York: Z.E. Kurzewell. 1968.

Walker, V., Cox, J., and Barnes, J.C. Becoming: A Human Relation Workbook. Dubuque Iowa: Kendall/Hunt Publishing Company. 1976.

IT'S ALMOST LIKE HAVING TWO BRAINS

A Study of the Collaborative Action Research Experience of Adult Education Teachers in Virginia

Laura Doyle and Susan Erno

Introduction

For many years, collaborative action research has enjoyed popularity in the field of education primarily as a staff development tool and, in some instances, as a way to generate new knowledge (Oja & Smulyan, 1989). Much has been written by university researchers and by kindergarten through 12th grade teacher-researchers about the benefits of collaborative action research (Mohr & MacLean, 1987; Kutz, 1992; Watts, 1985).

This is not true in the field of adult education. Although the education of adults is the key concern of the field, until recently, there has not been an emphasis on the education of the teachers of adults (Brookfield, 1986; Lytle, Belzer & Reumann, 1992; Fingeret & Cockley, 1992). Accordingly, we found no published accounts by adult education teachers who have done collaborative action research.

This study looks at a small group of 22 adult education teachers in Virginia to find out how they viewed their collaborative action research experience and what, if any, are their articulated perceived gains. We sought to address the following questions:

1. Do adult education teachers see a change in their teaching practice when they become researchers?
2. What do adult education teachers notice about themselves that they attribute to their collaborative action research experience?
3. Does this change last over time?

For the purposes of this study, we define action research as a process in which teachers and/or outside researchers conduct a planned and systematic inquiry of a question directly related and of immediate concern to their teaching practice. Collaborative implies that teachers were working together in some way with other teachers during this process.

Method

We contacted adult education teachers in Virginia who had participated in some form of collaborative action research. The instrument we used was a self-designed survey (see Appendix A). Initially, our population was a group of 11 Adult Basic Education (ABE) teachers who had completed collaborative action research projects in 1989-90 through a course sponsored by George Mason University and 9 teachers who recently worked on collaborative action research projects through the Virginia Adult Educators Research Network (VAERN). We later discovered another group of 11 ESL teachers who completed collaborative action research projects in 1989-90. We attempted to contact these teachers as well.

Of the initial group of 11 ABE teachers contacted, we received 10 completed surveys between January and April 1993. One survey was returned due to no forwarding address.

We also received from the course instructor the evaluations that this group completed in March 1990 at the end of the course (see Appendix B). The instructor had all but one evaluation; she recalled the missing evaluation as being especially negative. Nonetheless, this provided us with rich data to compare the change in response by teachers to the collaborative action research experience over time.

The second group of 9 teachers all completed and returned surveys in March and April 1993. These teachers worked in small teams with a facilitator and some had not yet completed their action

research project. They differ from the first group in that they did not receive class credit for their research; however, they did receive a stipend for their work.

The 11 ESL teachers were more difficult to reach as we did not have addresses for them. We used the Virginia Adult and Continuing Educators' Conference in Arlington, Virginia in March 1993 as a source of information about this group. We located 3 ESL teachers who had participated in the collaborative action research course and received surveys from them.

Other sources of data included telephone interviews with several teachers who completed the surveys and the conversation of a group of 3 teachers who reflected on their collaborative action research experience in a workshop at the aforementioned conference.

Results

The data analysis was somewhat difficult due to the nature of the survey - open-ended questions. We felt strongly that teachers should use their own words to describe their experience and we did not want to influence the results by using a checklist or Likert scale. Table 1 gives general demographic information about the survey respondents. See Appendixes C, D, E, and F for a partial transcription of survey responses.

By carefully analyzing the responses in each survey, three key themes emerged from the data. These are:

1. The heightened awareness of the relationship between teacher and learner - the duality of the role of teacher as learner in the classroom;
2. The teacher as researcher, experimenter - a willingness to try new ideas, strategies, be creative; and
3. The development of peer relationships - teachers sharing and learning from each other.

Looking at the first theme, the teacher-researchers in this study appear to be very reflective. They have become more aware of their role in the classroom and some of the conflicts that arise from being a teacher. Perhaps this is due to the fact that most of the teachers kept a classroom learning journal in which they wrote down their thoughts, observations, and questions during and after class meeting times. The writing process may have promoted observations and reflection.

> An ABE teacher writes: "Because of the research and journal entries I began to examine the working relationship between myself and my students. Thus, I was able to see weaknesses and strive for ways to correct them."

> An ESL teacher writes: "As a result of the journal I kept for a classroom observation, I am more aware of what I'm doing in class and how it affects the students. It took me outside myself, so to speak."

> A journal entry by an ABE/GED teacher states in part: "I find that the more I write, the more ideas keep surfacing in my thoughts, and I have to write more."

Secondly, teachers as researchers become experimenters, risk-takers. Teachers' comments include: "Action research gives you 'permission' to try new and innovative techniques. You can come up with projects that suit the needs of your students since you know them best." and "It seems that this project gave me the courage to try other new things in my class. Many of the ideas being researched by other class participants are ideas that I am trying in my class."

The third theme, teachers' sharing and learning from each other, seems to be an important benefit of collaboration. Over half of the teachers indicated that they liked sharing ideas with other teachers.

> An ESL teacher writes: "I especially enjoyed interviewing other teachers. I felt an increased respect for their intelligence, insightfulness, and commitment to the students.

BEST COPY AVAILABLE

I also enjoyed giving them the opportunity to air their opinions. We don't talk about what we are doing/seeing in the classroom enough."

An ABE/GED teacher states: "I was newer in adult education at the time I took the class. It was interesting to see other teachers struggling and facing the same problems I had. It made me feel that I was not alone."

In response to a question that asks what did you like about your research experience, a GED teacher writes: "Bringing myself up-to-date on the literature and sharing ideas with other teachers. Other teachers' insights are almost like having two brains."

Looking at the original questions, we can see that these themes relate to the first two questions. Adult education teachers do see a change in their teaching practice as a result of their research experience. Ninety-five percent of teachers surveyed said they saw a difference in themselves as teachers, and they attribute that difference to the action research experience. The following are representative comments:

"It [the Action Research course] has changed my focus from what I want/like to teach to better meeting the needs of my students." (ABE Teacher, 1990)

"I pay more attention to the reasons why I teach as I do. I question my motives, teaching techniques, questioning methods more than I did before." (ABE/GED teacher, 1993)

An ESL teacher, the only one to reply that the experience did not affect her teaching, states: "Not yet. I still think hard about things but don't always ferment a plan." Her comments imply that she may see a change in the future.

The final question deals with the impact of collaborative action research over time. Do the teachers who participated in the 1989-90 action research course continue to see a difference in their teaching practice? The survey responses indicate that this group still sees collaborative action research as positively impacting their current teaching practice. The evaluations completed in March 1990 show positive changes in their teaching practice. Taking into account that the missing survey was a negative one, 91% of this group immediately saw positive changes in their teaching practice. On the 1993 survey, 90% said they saw a difference in themselves as a teacher. Some of their comments on the 1993 survey include:

"I'm a better observer of my students - improved quality of listening and able to see patterns of behavior better."

"I look at things in a more creative way. I am more likely to try different methods of teaching and more likely to document the class's reaction and progress. I am more interested in trying methods used by other teachers and adapting these methods to my teaching style."

"I feel my teaching is presented in a more interesting way which helps to create and hold the interest of the students, making it more meaningful for them."

Although teachers, for the most part, viewed their action research experience positively, they also shared their concerns. These include: the uncertainty of the process, lack of resources, large quantity of work and time involved, difficulty of writing, and lack of support.

Three teacher-researchers stated in a VAACE workshop the specific type of support they needed as follows: the guidance of a facilitator, the emotional support of other teacher-researchers, financial support for the amount of time invested, and affirmation outside the circle of teachers that their work is valued.

When asked what she didn't like about the experience, an ESL teacher writes, "The project was initiated for political/funding purposes; the participants felt 'used'. The research component was not clear. Really, I just collected teaching materials and did a survey of textbooks." Despite this experience, this teacher is willing to pursue further research projects. She adds, "I can see that there is a much more supportive environment now. I would expect a truly teacher-centered, goal-setting stage at the beginning and ongoing support."

Because of the small size of this study, these findings are not generalizable. However, they are significant in that they show that collaborative action research can be a powerful learning experience for adult education teachers.

Discussion

The responses of the teacher-researchers in this study mirror much of current research about the benefits of collaborative action research. When Goswami and Stillman (1987, cited by Cochran-Smith & Lytle, 1990) talk about the transformation of teachers who become researchers they say in part:

1. "Their teaching is transformed in important ways: they become theorists, articulating their intentions, testing their assumptions, and finding connections with practice."
2. "Their perceptions of themselves as writers and teachers are transformed. They step up their use of resources; they form networks; and become more active professionally." (preface)

It seems clear that adult education teacher-researchers are seeing themselves differently in the classroom. Their writings are filled with evidence. "I am a better listener. I am more aware of my responsibility to set the tone...I pay more attention to the reasons I teach as I do. I am more aware of my motive." These are typical responses from teacher-researchers in our survey.

Another effect enumerated by Goswami and Stillman is:

3. "They become rich resources who can provide the field with information it simply doesn't have. Teachers know their classrooms in ways that outsiders don't." (preface)

Although the survey did not specifically ask about how teachers were sharing their findings, several teachers mentioned that they were presenting at professional conferences. One teacher, interested in the research findings of a colleague, states, "Her report got me more interested in using calculators. I pursued a VAACE research grant, bought and used calculators in my class. I do workshops for teachers and volunteers on using calculators." Estimating conservatively, at least half of the teacher-researchers in this group have formally presented at one or more professional workshops.

Implications for Practice

Mohr (March 1993) recently described the following attributes of a teacher-researcher:

"Theorist: a thinker, reflector, one who reads and writes about theories; develops paradigms; talks to colleagues.

Researcher: one who has a skeptical frame of mind; sustained by critical principles; asks questions; writes.

Practitioner: a reader; one who tries out things; gets 'in-serviced' to learn research and theory."

Mohr envisions a new definition of teacher as a synthesis of theorist, researcher, and practitioner. She states unequivocally, "I am best as a teacher when I am all three."

Like Mohr, we think that collaborative action research is an effective and powerful tool for adult education teacher to learn and grow as professionals. Action research encourages and supports teachers

as owners of their learning experience. When teachers become learners in their own classroom, they become excellent examples of self-directed learners for students. Teacher-researchers demonstrate that they value their students, that teachers are also learners, and that no one, not even teachers, has all the answers.

Although none of the teacher-researchers in our study actually said that they became a better teacher because of the collaborative action research experience, certainly, their comments show that their teaching has been transformed. An ESL teacher writes, "I think I'm more observant, take more notes, watch 'how' the students learn - not only the content but the process."

Our own experience as teacher-researchers has given us insights into the process; however, we tried to give an unbiased accounting of the data we obtained. Susan was a member of the 1989-90 action research group. Both of us have done this research project under the sponsorship of VAERN.

Unanswered Questions

Through our research we found that collaborative action research projects have been successfully pursued and completed by 22 adult education teachers in Virginia. These teachers tell us both the benefits and the drawbacks of this process. It seems clear from their comments that the benefits outweigh the drawbacks; however, the issue of support must be addressed before action research can become a popular practice among teachers.

A teacher-researcher said recently, "I love action research, but I can't afford to do it right now. It is too time-consuming for the money we are paid." The first question then is, how can teachers be adequately supported and compensated in their pursuit of action research?

The next question concerns the aftermath of the action research project. After a research project is completed, how can the findings reach a larger audience and contribute to the field beyond the teacher-researcher's own classroom? How can adult education teacher-researchers become a voice in the larger field of education?

Finally, can the system of adult education adjust to the changes that occur as a result of the learning experience? The system of adult education al all levels must be able to adjust and grow as a result of the changes made by teacher-researchers. Jarvis (1992) points out, "People, then, grow and change as a result of learning; this is a continuous process throughout life; organizations, though, have a tendency toward inertia. People prefer harmony rather than the tension of change and new ideas, so that some managers prefer to train employees to 'fit in' rather than enabling them to grow and perhaps become change agents." (p 218-219). Through the process of collaborative action research, teachers are experimenting with new ideas and can become change agents. Is the system of adult education willing not only to support teacher-researchers through the process, but to change and grow because of the process?

We would like to think that there is a bright future for collaborative action research by adult educators; however, the issues addressed in this paper first must be resolved. Collaborative action research by adult education teachers can enrich both the teacher-researchers and the larger system of adult education. Hopefully, an update on this paper in five years will reveal a plethora of articles by adult education teacher-researchers.

Attachment:

Table 1: Demographics of Respondents

Appendix A: Teacher-Researcher Survey
Appendix B: VAILL Action Research Seminar Evaluation
Appendix C: Responses - Evaluation Summary March 1990.
Appendix D: Responses - Action Research Course 1993
Appendix E: Responses - VAERN Projects 1993
Appendix F: Responses - ESL Teachers 1989-90 Course

Table 1: Demographics of Respondents

A. Educational Background

Highest Level of Education	Number of Teachers
Bachelors Degree-Education Major	7
Bachelors Degree-Other than Education	5
Masters Degree-Education Major	4
Masters Degree- Other than Education Major	6

B. Years Experience in Adult Education

Number of Years	Number of Teachers
1-3	2
4-6	10
7-10	3
11-14	4
15+	3

C. Current Position

Job Description	Number of Teachers
Teacher-ABE, GED, ESL, Family Literacy,Jail,& or Prison*	19
Administrator-Adult Education	2
Not currently in Adult Education	1

* Most teachers worked in more than one setting, e.g. ABE, GED, and Workplace..

Appendix A

SURVEY FOR TEACHER/RESEARCHERS

BACKGROUND DATA:

Describe your teaching responsibilities-Check as many as apply: __ ABE __GED __WORKPLACE __FAMILY LITERACY __ESL __OTHER (please specify)

How many years have you been an adult educator?_____

If you no longer teach adults, please give the date you last taught and the reason you left the field. _____

_____

_____

EVEN IF YOU NO LONGER TEACH, PLEASE CONTINUE TO COMPLETE THIS SURVEY.

What is your educational background?_____

_____

Please list any additional adult education staff development activities in which you have participated in the past three years._____

_____

_____

- -

1. Do you see a difference in yourself as a teacher as a result of your experience in collaborative research? Please explain._____

_____

_____

_____

2. What did you like about your research experience?_____

_____

_____

_____

3. What didn't you like about this experience?_____

_____

_____

_____

4. Are you interested in pursuing further research in your classroom or with other teachers? _____

_____

5. If you were to again participate in a collaborative research project, what would you do differently?_____

_____

_____

6. How does your experience with collaborative research compare to other forms of staff development activities?_____

_____

_____

_____

Any additional observations?_____

_____

_____

Please use the reverse if more space is needed.

THANK YOU FOR YOUR HELP!

Appendix B

VAIL Action Research Seminar Evaluation

Because of the part-time nature of the majority of the ABE Teaching positions in Virginia and because of the relative isolation experiences by most of our teachers, there are few opportunities to "network" and to share problems, solutions, and ideas. In addition, certification is not required and courses in adult basic education are few and far between. Further, there is little research conducted in the adult basic education field. Our teachers learn "on the job" with little preparation, few supports, and limited training. Yet, they have a remarkable impact on their students' lives and they know a tremendous amount about what works with their students and what does not work TEACHERS ARE OUR BEST RESOURCES. The VAIL '89 Action Research seminar course was an experimental attempt at capitalizing on the knowledge of a self-selected group of teachers while at the same time providing them with a mechanism for systematically examining and improving their won teaching practices.

Your research on effective instruction is unique in the adult basic education field an the report on your findings will provide other teachers in Virginia with some valuable information that they can use int their classrooms. In addition, the work that many of you have done should be disseminated to an audience outside of Virginia - perhaps in an article or newsletter.

In my view, the class has been a very informative and effective means of staff development. We have all benefited by the knowledge and experiences of a group of dedicated classroom teachers.

Please take a few minutes now and give some thoughtful attention to this class evaluation. If you are in favor of this type of an approach for staff development in Virginia, write your responses as though your were communication with the State staff. In addition, provide some carefully thought-out suggestions about ways to improve the class delivery.

1. Do you feel that this course has had an impact on your instruction? Why or shy not? Be as specific as possible.

2. How do you feel about action research courses as a means of staff development for ABE teachers in Virginia?

3. What did you like best about the course?

4. What suggestions for improvements would you make?

5. Describe briefly a few of the concepts, theories, or ideas which you have learned as a result of participation in this course.

Appendix C: Responses on VAIL Action Research Seminar Evaluation Summary-March, 1990. George Mason University

1. Do you feel that this course has had an impact on your instruction? Why or why not? Be as specific as possible.

This course has put me in better touch with my classes. My observations have made me reflect on my student(s') needs and accommodate them. In a sense, my students have become the teachers to me and I am a better teacher because of it. For growth as a professional, classes such as this one are essential.

Yes, it provided a catalyst to take the time to explore the possibilities of activities to use with adult students who are not motivated, "turned off by school", and/or learning disabled.

This course exposed me to new ideas and concepts. I was able to explore an idea fully with the support of many who could recommend the resources I needed. I got very specific resources that I then had to track down. Without this course the idea I explored and worked with probably would not have been thoroughly implemented.

Yes, it has changed my focus from what I want/like to teach to better meenting the needs of my students. It has allowed me to interact with ABE teachers across the state. This has given me a broader perspective of what ABE is and who is doing it. More important it has given me many strategies to use with my students.

This class or course has had a definite impact on my instruction. Because I was committed to this task I found that my focus was much clearer and my goals were set. This made me a better instructor. I was committed to using various strategies and as I worked through the year I found that the constant use of these strategies was most beneficial to my students.

I think that just to say that this course had an impact on my instruction is not enough. The course has brought about a pooling of ideas that could be tried, experiencing the first hand results of the impact they have on the students we teach, The methods were only a small part compared to the questions that came to mind as the course progressed and the research knowledge we discoveres in our search.

This course has definitely had an impact on my instruction. I have spent a great deal of time reflecting on my methods of teaching and observing my students to find out what works and what doesn't. I have learned many new and useful techniques from other adult teachers that I have used successfully in the classroom.

The course has impacted my instruction because I took a longer look at what I was doing previously and decided to change my methods. I was able to develop a more student centered/directed curriculum.

Yes, the research that I have done has helped me to better understand my topic and to find ways to make it work effectively with my population. I see from experience that group discussions do promote the critical thinking skills of my men.

Yes, I feel I read material that I probably would not have otherwise and now I have a better understanding of braille and the developmental process in spelling. In looking at my data, I realize that I have had more success than I thought.

Appendix D: 1993 Survey Responses of Teachers who Participated in 1989-1990 Action Research Course

1. Do you see a difference in yourself as a teacher as a result of your experience in collaborative research? Please explain.

It made me think about returning to a more traditional teaching setting. I want a teaching environment where growth as a teacher is encouraged and time allotted.

Yes, my perspective has broadened, been enriched, etc.

Because of the research and journal entries I begin to examine the working relationship between myself and my students. Thus I was able to see weaknesses and strive for ways to overcome or correct them.

Yes, I feel my teaching is presented in a more interesting way which helps to create and hold the interest of the students and making it more meaningful for them.

I only used this for one yr. because of a change in my job responsibilities. Perhaps I was a little more willing to experiment.

I look at things in a more creative way. I am more likely to try different methods of teaching and more likely to document the classes reaction and progress. I am more interested in trying methods used by other teachers and adapting these methods to my teaching style.

The experience of other teachers helped but I didn't have a class then-only one literacy student.

Yes, the sharing that those of us who took the class participated in each class meeting.

Yes, I have been made much more aware of my students as individuals and their need to be individuals.

2. What did you like about your research experience?

Learned a lot.

The insight and ideas received from the class professor and fellow students and the readings.

Bringing myself up-to-date on the literature and sharing ideas with other teachers- other teacher's insights are almost like having two brains.

I liked discussing and sharing with other teachers. Often they could be more objective and give you a different perspective. Also, I think any teaching situation is somewhat "trial and error" particularly in adult ed. What works with some may not work with others. Action research gives you "permission to try new innovative techniques. You can come up with projects that suit the needs of your students since you know them best.

The cohesiveness of the research and the follow through of that cohesiveness.

Networking with the other members and learning of their experiences in the teaching field.

The sharing experience, It was similar to taking on several research projects at one time because of what you learned listening to the other teachers' experiences.

I liked sharing information with others. It made me feel less isolated. Also I felt I had something to contribute. It gave me a sense of control.

I liked the textbook that was assigned. I got to understand the complexity of braille and how it relates to spelling problems.

The intense concentration on the 3 students whom I interviewed and worked most closely with.

Appendix E: 1993 Survey Responses of Adult Education Teachers who Participated in VAERN Collaborative Action Research Projects

1. Do you see a difference in yourself as a teacher as a result of your experience in collaborative research? Please explain.

Yes, I think I question how and why things happen more. I am constantly changing how I present things.

Yes, as a result of the journal I kept for a classroom observation, I am more aware of what I'm doing in class and how it affects the students. It took me outside myself, so to speak.

Yes, I am more aware of my responsibility to set the class tone and how my students see me as a focal point to the class.

Yes, I'm a better listener. I am more aware of students' needs and problems.

Yes, have been more critically aware of my practice and implemented some of my findings.

Yes, I am teaching goal-setting, time management, and bonding activities in my class now. This research has made me more aware that these three factors are important for keeping students until they reach their goals. Our research team members all agreed that we need to help our students set smaller goals that are more quickly attainable before setting the GED as a goal.

Yes, I pay more attention to the reasons why I teach as I do. I question my motives, teaching techniques, questioning methods more than I did before.

Not yet, I still think hard about things but don't always ferment a sound plan.

2. What did you like about your research experience?

Validates teachers as able to analyze their own practice.

Getting students back into a program after interviewing them. Meeting people from other programs and comparing our situations. Visiting Maple Hill.

Gave me a foundation from which to work, didn't feel so isolated.

I especially enjoyed interviewing other teachers. I felt an increased respect for their intelligence, insightfulness, and commitment to the students. I also enjoyed giving them the opportunity to air their opinions. We don't talk about what we are doing in the classroom often enough.

I enjoyed interviewing students and teachers. I learned a lot from other members of the research team. I enjoyed working with Sue Cockley. She did a great job.

Sharing with Diane Foucar-Szocki and other teachers involved in the project-exchange of ideas and experiences helpful- also the journal was useful.

I like investigating a question, gathering data from a variety of sources, talking with other teachers and writing about subjects that are unique. This experience has given me positive feedback.

Working out things with other people because it informed me.

Appendix F: Survey Responses by ESL Teachers who participated in 1989-1990 Action Research Course

1. Do you see a difference in yourself as a teacher as a result of your experience in collaborative research?

I think I'm more observant, take more note , watch"how" my students are learning what the learn-not only the content but the process.

I had to think about my practice as a teacher and present those findings in a report. I also used the data in a workshop. It did help me evaluate standard texts more critically with students.

Yes. Research allows me to test what I know or presume instinctively and to gain insight from others.

2. What did you like about your research experience?

I like discovering new aspects of a research question.

Working closely with students as my research partner- then on a more equal basis as they shared and worked with me.

Working with my colleagues.

Bibliography

Brookfield, S. Understanding and Facilitating Adult Learning. San Francisco: Jossey-Bass. 1986.

Cochran-Smith, M & Lytle, S. "Research on Teaching and Teacher Research: The Issues that Divide." Educational Researcher. 56. March 1990. p. 481-95.

Fingeret, H.A. & Cockley, S. Teachers Learning: An Evaluation of ABE Staff Development in Virginia. Monograph. Virginia Adult Educators Research Network. 1992.

Kutz, E. "Teacher Research: Myths and Realities." Language Arts. 69. 1992. p. 193-197.

Jarvis, P. Paradoxes of Learning. San Francisco: Jossey-Bass. 1992.

Lytle, S., Belzer, A., & Reumann, R. Invitations to Inquiry: Rethinking Staff Development in Adult Literacy Education Technical Report TR-92-2. Philadelphia: National Center for Adult Literacy. 1992.

Mohr, M. Address at the Virginia Association of Adult and Continuing Educators' Conference. Arlington, VA. March 27, 1993.

Mohr, M. & MacLean, M. Working Together - A Guide for Teacher-Researchers. Urbanna: National Council of Teachers of English. 1987.

Oja, S.N. & Smulyan, L. Collaborative Action Research: A Developmental Approach. Philadelphia: Falmer Press. 1989.

Watts, H. When Teachers are Researchers, Teaching Improves. Journal of Staff Development, 5-6, 1985 p. 118-127.

CALCULATOR USE IN MATHEMATICS INSTRUCTION AND STANDARDIZED TESTING: AN ADULT EDUCATION INQUIRY

Review of the Literature 1976 - 1993

Martha Gilchrist

Introduction

In 1911, the first commercial mechanical desk calculator was marketed, followed in 1930 by the first electric calculator from the same company. The first electronic calculator, which included a square root key, appeared in 1960. In 1967, Texas Instruments invented the first hand-held electronic calculator, but did not enter the consumer market until 1972 "with the Data-Math Calculator - an 'inexpensive' ($160) four-function, hand-held calculator" (Kennelly, 1989). The rest of the story, as they say, is history. During the past two decades, the hand-held calculator, now available for as low as two percent of its original cost, nearly rivals the television with respect to the degree of integration into American society.

Why, then, has this little machine become such a problem for mathematics education in the United States?

Cultural and Historical Perspectives

There appears to exist in American society a widely-held belief that the successful learning and application of mathematics is the result of innate ability or a gift such as is possessed by accomplished practitioners of the fine arts. Some people are "good at mathematics" and some are not.

A rival hypothesis might argue that the learning of mathematics is an incrementally-developed mechanical process, and that success is related more to drill and practice than to natural aptitude. Those who take the time to learn mathematics do learn it, and those who don't, don't learn it.

Though the second belief is more optimistic, the prevalent corollary to either one is that mathematics must involve a certain degree of pain, even if one is "gifted." Hoffman (1991) wrote that "mathematics is seen as a test, not only of brains, but of character, of whether someone has the grit to calculate problems day after day, year after year. No wonder people hate it."

Since the calculator represents a way of alleviating a part of the pain, it is regarded by some as a brain-rotting device. But the invention of aids to facilitate mathematics is nearly as old as the practice of mathematics itself.

While the arts were developed in response to the need of humans to express their spirituality, mathematics, on the other hand, had its beginnings firmly rooted in pragmatism. When humankind began to acquire personal (versus communal) property, presumably the idea that "more is better" rapidly became a part of the species' mindset. This trend toward acquisition created the critical problem of how to make sure that one's aggregate of possessions remained intact, for in the earliest societies theft was considered to be a mark of prowess, not an immoral act. Thus, humankind taught itself to count in order to account for its individual stores of wealth. The fingers and toes were capital instruments for setting up one-to-one correspondences; it is no wonder how the decimal system developed. When the need to count greater than twenty arose, other countable objects were employed, the most favored being small stones or pebbles, called "calculi." The use of calculi soon led to systems of "calculation," practiced in various ways and stages by the different developing subsets of humanity. Any method or device that could facilitate a mathematical process was eagerly embraced and utilized.

Next in the progression was the need to measure. Body parts (hands, arms, feet) were used as standards. Rudimentary bookkeeping was developed by the early purveyors of commercial goods. Evidence of the use of algebraic formulas was found in the remnants of both early Egyptian and Indian civilization. Some mathematical knowledge, such as the use and value of pi, was able to be carried from culture to culture as humans began to explore their world. With the rise of more advanced and stable civilizations, such as that of the Greeks, mathematical knowledge became systemized. The various

inventions, the theorems, the formulas, and the simple machines were passed on through successive generations and became the basis for mathematics even as it is known today. It was truly an evolutionary phenomenon of human intellect, as over time incremental improvements to original ideas and further innovations, each building upon one another, provided the means by which mankind would attempt to gain mastery over an insecure earthly existence. It was a process which still continues even after many centuries. The point that must be kept in mind is that any proven and useful aid that could make easier the learning and application of mathematics was treasured and preserved and regarded as a stepping-stone to greater heights of achievement.

The earliest known calculating machine was the abacus, thought to have been in use since the year 1000 B.C. It is supposed that the original beads of the abacus were the "calculi" or small stones used for counting. In 1642, Blaise Pascal, the French philosopher and mathematician, at the age of nineteen, built a "computing machine" (Durant, 1963). Pascal's machine was limited to addition, but thirty-one years later, Gottfried Leibnitz of Germany "contrived a computing machine that improved upon Pascal's by performing multiplication and division as well as addition and subtraction (Durant, 1963).

Twentieth century development of the calculator has been noted above. The calculator's prevalence in modern society is undeniable, yet the little machine has proven to be a major bone of contention for mathematics education and its two components, instruction and testing. Instead of taking its place in the long line of welcomed mathematical inventions behind the abacus, the Pythagorean Theorem, logarithm and trigonometric tables, and the slide rule, the hand-held calculator has been branded by many in society as an instrument of mental destruction.

Review of the Literature

This paper examines a selection of the body of professional writing that the calculator issue has engendered during the period 1976 to 1993. The breakdown of topics is as follows: (I) the calculator in mathematics instruction, (II) the calculator in standardized mathematics assessment; and (III) a sample of research on the calculator in mathematics education.

I. The Calculator in Mathematics Instruction

Use of the calculator in the teaching of mathematics has met with almost universal acceptance by practitioners.

Our age is one of rapid technological change. Most of us, in this country at any rate, have to accept as our destiny the fact that we are factors of production in a major industrial economic power. We live in an era of discontinuous change. We have the option of deviating from these new societal norms, but only if we are willing to accept personal isolation. Most of us are not. Most of us are willing to adapt to the changes that affect our lives.

Many teachers believe that it is vital for mathematics education to follow these social trends, but there has been at the same time resistance to employing new technologies, such as calculators, in the classroom, mainly because calculators have historically not been allowed on standardized tests which attempt to measure the effectiveness of classroom instruction. But many teachers are concerned about the content of the mathematics curriculum itself; they believe it has retained the form of a "saber-tooth curriculum" (Heid, 1988).

In 1954, B.F. Skinner wrote: "We are on the threshold of an exciting and revolutionary period, in which the scientific study of man will be put to work in man's best interest. Education must play its part. It must accept the fact that a sweeping revision of educational practices is possible and inevitable" (Berlin, 1987). Thirty-four years later, Skinner's admonition had not been thoroughly integrated:

> It is 1987. We have probed both far into space and to the depths of the oceans. Technology has enabled humans to walk on the moon several times; it has helped scientists to find the Titanic on the ocean's floor. Many of George Orwell's prophecies have come true, a number of them before the year 1984. Technological advances have made the lives of many citizens easier and more productive. But elementary school students in classrooms across the country still are being taught the long division algorithm using pencil and paper. Why? (Williams, 1987)

The purpose of education is to prepare students to adapt to life in economic reality. That is why "it is inconsistent for us to use calculators daily in our adult lives for personal and business purposes and yet deny students the opportunity to explore the power of this technology" (Kaiser, 1991).

Long division is a case in point, as mentioned by Williams, above. Long division is one of the great traumas of learning mathematics.

> What exactly is the value of long division, or any of the rudimentary arithmetic skills, in the age of the computer and pocket calculator? "What is it we expect students to learn?" asks Thomas Romberg, a professor of curriculum and instruction at the University of Wisconsin at Madison. "If we're preparing them to be Victorian clerks with quill pens and green eyeshades, we're not doing our job. There isn't anyone out there anymore who makes his living doing long division" (Adler, 1991).

The American workplace is an environment which prizes efficiency above all; survival in the market depends upon it. Both the manufacturing and the service sectors must be constantly updating and adjusting to technological innovations. Computers and calculators are now considered necessary equipment and only the most rudimentary of businesses lack them. Computers and calculators offer two crucial advantages over manual systems of any kind: speed and accuracy. People who enter the workforce where the manipulation of numerical data constitutes any part of their jobs must come to work already proficient in the use of computing and calculating machines or they must be trained on the job. Mathematics teachers appreciate the realities of the workplace situation and want to teach a curriculum which will prepare their students adequately for it. In an attempt to give expression to the concerns of mathematics teachers that students need increased emphasis on technology combined with mathematics, Chambers (1989) wrote "we are not seeking better performance on a computation-based curriculum, but better performance on a curriculum better suited to the needs of Americans in the 21st century."

Bell (1978) wrote that there are "concerns about what should remain as 'basic skills' in a computer/calculator age." The majority of mathematics educators will be quick to say that the emphasis in mathematics education should be on developing problem solving skills. Historically, the largest focus of mathematics instruction has been the learning of computational algorithms, or rules for performing computations. In some classroom situations it was found that as much as ninety percent of the time was allocated to computation activities. One commonality found by mathematics teachers is that students of virtually all ages will express dislike (or perceived dislike, at any rate) of "word problems." The reason that people hate word problems is that they simply have not had very much training in, and experience with, them. Most mathematics teachers view calculators as a way to eliminate repeated algorithmic instruction year after year. It should be made clear that those who advocate calculator use in the classroom, even in elementary classrooms, are not saying that computational algorithms should not be taught at all. In fact, they believe that students should be able to perform calculations with paper and pencil, as part of the process of developing what is know as "number sense" or an intuitive feel for manipulating numbers in various kinds of calculations. Prevalent opinion among mathematics teachers indicates the belief that from the primary grades on, calculators should be used for exploratory arithmetic operations and that students should be taught how and when to use calculators (Math Frame, 1987). What mathematics teachers wish to get away from is the inordinate amount of time spent on practicing computation. Wheatley (1992) wrote that "calculators represent a powerful alternative to the drudgery and inefficiency of paper and pencil arithmetical computation." Mercer (1992) believed that "once we realize what is truly important in mathematics we will be less inclined to stick to our past prejudices about the

necessity of training our students to do mechanical tasks." Not using calculators in the classroom seemed to Countryman (1991)

> to deny students the opportunity to increase their understanding of mathematics. Our students need time for mathematics: to explore, discuss, describe, interpret, organize, collect, predict, solve. They need the experience of selecting and using appropriate tools and methods. They need practice in applying a variety of mathematical techniques in the solution of real-world problems. They need to use the language and notation of mathematics to express quantitative ideas and spatial relationships. They need practice in constructing valid arguments. Using an inexpensive calculator to enhance their learning of arithmetic will give students more time to develop real mathematical power.

Reys (1989) felt that

> ...the students can concentrate on the concept rather than the tedious computation. Students will still make computational errors, often key-stroking errors, but doing the calculations over again is not a chore... For a teacher, this approach provides the additional time needed to bring meaning to the concept and helps retain students' interest in the concept. A greater variety of examples and different kinds of data can be considered, and more realistic data sets can be examined.

Mathematics teachers have also found that as calculators are increasingly woven into classroom instruction, the process of estimation, and mental arithmetic as well, are both making a comeback within the mathematics curriculum. Wheatley (1992) explained:

> When an individual makes the decision to use a calculator in some way, she or he often performs a thought experiment. In deciding how to carry out certain arithmetical operations, an individual will often construct an anticipated sequence of moves and "run through" the activity mentally before actually entering the numbers.

Estimation of answers has taken on new meaning where calculators have been used for classroom instruction because a student has to have a "ballpark" idea of what the answer to a problem should look like before it pops up on the calculator's display. The student must first distinguish between outrageous answers and answers that fit the general parameters of the problem at hand, and then, must be able to judge how close to the correct answer the calculator's output is. Before calculator use began in classrooms, estimation was only a discrete topic in the sequence of a mathematics textbook; with calculators, it becomes almost second nature.

Some teachers have had success using calculators with students who after eight or nine years of school still cannot perform paper and pencil algorithms, due to learning disabilities or other problems. Many teachers feel that mastery of computational algorithms is not necessarily a prerequisite to moving on to higher forms of mathematics. At some point in children's education, the emphasis given to computation must diminish and problem-solving must become predominant, even if the computational algorithms are not mastered. Many adult basic education teachers also believe that time should not be wasted teaching computational algorithms in their classes because of the students' needs to apply their learning immediately to occupational and personal situations.

The most definitively documented result of calculator use in the classroom appears to be the positive effect on student attitudes toward mathematics in general. Finley (1992) described the changes which took place in her fourth and fifth grade level mathematics class after she decided to integrate calculators into instruction:

> Calculators have been wonderful as a tool for building confidence and self-esteem in students. Students love to be right and to feel that they have the ability to reason something through. The calculator affords them many opportunities to be correct and to

box that can be used as a substitute for understanding, and these students will resist the arduous mental effort that is required to develop a feel for numbers and the ability to estimate." Saxon did concede that calculators could be successfully used at the high school level, but only after students have acquired the fundamental concepts of arithmetic.

Marilyn Suydam's (1976-1982) research uncovered some opposition to the use of calculators in mathematics education; these are discussed below in detail.

Pfeiffenberger's and Zolandz' (1989) survey of pre-college science teachers' attitudes on calculator use included the following negative responses:

> -math skills are not learned or [they] atrophy [with calculator use]
> -students may simply manipulate the numbers to match a choice instead of solving the problem
> -[calculator] use creates a lack of math and analytical skills in students, and thus students don't understand the basic concepts involved.

Usiskin (1975) commented that a popular metaphor used in opposition to calculator use in mathematics education was that the calculators were a "crutch." His response was that

> the crutch premise is seriously open to question, both in its internal validity and in the validity of the conclusions that are reached from it. The crutch premise rests on the principle that a crutch is a bad thing. But in fact, for the injured person a crutch may be a good thing - even a necessity. The capacity for a crutch (bad!) to be relabeled a tool (good!) extends to many situations, and many value judgments may simply depend on which label is perceived as accurate.

Documented opposition to the use of calculators in mathematics instruction has been minuscule when compared with the volume of support positions taken. Especially in recent years, the literature is virtually devoid of negative statements. Higgins' (1990) summation was that "despite the publicity given to arguments about using calculators in the mathematics classroom, I believe that we are devoting time and energy to a nonissue. The real issue is not whether calculators should be used in mathematics classrooms; it is how they should be used in classrooms."

II. The Calculator in Standardized Mathematics Assessment

A part of the initial effort to move toward calculator use on nationwide standardized tests was the decision of the College Board to permit, but not require, the use of calculators on the Advanced Placement (AP) calculus examinations given during 1983 and 1984. This was carried out on an experimental basis, with the effect that after 1986 the College Board reversed its policy of calculator use on AP examinations due to "the practical problems of administration and the concerns of equity" (Kennelly, 1989).

However, the College Board will once again take the pioneering step of allowing calculators on the Spring 1994 administration of the Scholastic Aptitude Test (SAT) and to phase the policy in, will also permit calculator use on the Preliminary Scholastic Aptitude Test (PSAT) and the National Merit Scholastic Qualifying Test (NMSQT) in the Fall of 1993.

In 1986, a symposium on Calculators in the Standardized Testing of Mathematics was sponsored by the College Board and the Mathematical Association of America. The Symposium "endorse[d] the recommendations made by the National Council of Teachers of Mathematics, the Conference Board of Mathematical Sciences, the Mathematical Sciences Education Board and the National Science Board that calculators be used throughout mathematics instruction and testing" (Kennelly, 1989). However, the symposium decided against recommending calculator use on the SAT at that time "because of the importance of the SAT in the college admission process as well as the nature of its mathematical content" (Kennelly, 1989).

During the years 1986-1992, the College Board, in concert with the Educational Testing Service (ETS), which develops and administers the SAT, continued to investigate the feasibility of calculator use

> receive instant gratification. When they are using paper and pencil and make a computational error, they are more often penalized for the error in computation than praised for correct reasoning. Even if they are praised for their reasoning, the praise is somewhat tainted by the fact that the answer was not exactly right. The calculator helps the teacher in getting the point across that reasoning is the most important step, and it allows the student to feel the great satisfaction that accompanies success.
>
> One especially gratifying incident occurred in that first year of calculator use. I found one of my students, who had a particularly hard time with mathematics, working very intently on a problem and using the calculator to try out his different theories. It was rewarding enough that he had progressed to the point of even having a theory and that he was willing to try it out on his own without asking for help first. But my true reward came when he finally approached me, with calculator in hand, and said, "Is this right?" Before I could say a word, he looked at the calculator again and said, "No that's not right. Something is wrong. Let me try again. I think I know what I did wrong." He didn't even wait to hear my response or look up to see the big smile on my face. He was too intent on solving his problem. At the beginning of the year he would have never gotten past the first simple computation using paper and pencil before he would have been totally frustrated and unable or willing to pursue any kind of logic.

Countryman and Wilson (1991) wrote that with calculators their students were "engaged and enthusiastic about the fundamentals of mathematics." Kaiser (1991) reported that "after a few weeks of varied experience using calculators, my [sixth grade] students displayed enthusiasm for calculators and greater facility in mathematics in general" and that "students were eager to come to mathematics class when calculator use was permitted." Reys (1987) asserted that

> the evidence is strong that the use of calculators has many noncognitive benefits. For example, research suggests that students exhibit more enthusiasm and confidence in problem-solving when calculators are available. Students using calculators also have more positive attitudes toward mathematics and demonstrate greater persistence in solving problems [and] are more willing to seek alternative solutions.

Yvon (1987) believed that "students who become mired in drill activities are often prevented from seeing the beauty and enjoying the fun of mathematics" and that "the use of calculators can and will encourage students' creativity in all aspects of mathematics."

A survey of classroom teachers of all grade levels in Missouri conducted in 1979 to investigate attitudes toward calculator use produced the following outcome:

> more than eighty percent of [the teachers] reported observing attitudinal changes in their students. Without exception these changes were positive and were characterized by teacher comments describing students as being eager to attack problems, showing greater confidence in ability to solve mathematics problems, and becoming more excited about doing mathematics (Reys, 1980).

Boling (1977), in a study of twelfth grade consumer mathematics students, reported that "strong positive attitudes toward the use of calculators in the classroom were found."

Opposition to calculator use in mathematics instruction has not been non-existent. The most vocal critic was John Saxon, a textbook publisher. In an article which appeared in the Wall Street Journal on May 16, 1986, Saxon asserted that "students will be unable to do simple computations in their heads, and worst of all they will not be able to estimate." In this same article, Saxon referred to mathematics education in the United States as a "national disaster." A year later, in a professional mathematics education journal, via a paid advertisement, Saxon (1987) wrote that calculator use in elementary schools "will cause great damage to many children, and will provide only marginal benefits to a few" and that "introducing calculators in elementary schools will convince many students that the calculator is a magic

on the SAT. What kept the issue alive was the overwhelming support of mathematics educators. From 1987-1989, both the College Board and the ETS conducted studies to determine the effects of calculator use on the SAT. New versions of the SAT were developed in 1991 and field-tested the following year. Rigol (1993) reported that "more than 180,000 students from 2,221 schools throughout the country participated in perhaps the largest field of a new test ever administered." In addition to the analysis made from comparing scores of students who were permitted to use calculators on the SAT during the field trials, other kinds of data were solicited from the students pertaining to personal use of calculators, ownership of or access to calculators and students' opinions as to whether calculators should be used on the SAT. Analysis of the score data revealed a slight advantage in using calculators on the test.

The American College Testing (ACT) program is likewise "evaluating the role of calculators in its mathematics tests and is currently studying the impact of calculators on examinees' performance" (Noble, 1992).

Individual state testing programs have also begun to incorporate calculator use on mathematics assessment instruments. In Connecticut, in 1984, the state department of education began developing mastery tests in mathematics to be given in the fourth, sixth, and eighth grades, replacing a single proficiency test administration given in the ninth grade. The calculator issue was present early on in the new test development as a previous (1981) publication of the state department of education had specifically stated that "the widespread availability of calculators cannot be ignored when developing a mathematics curriculum" (Leinwand, 1992). The first test administration was conducted in 1986, with refinements currently being made.

In Michigan in 1986, the state Council of Teachers of Mathematics undertook the preparation of "new mathematics objectives as a model for instructional guidelines" as part of an "overall plan to develop a state test based on the objectives" (Payne, 1992). The Council decided from the start of the project that "calculator use be assumed as integral parts of instruction and testing" (Payne, 1992). As in Connecticut, the Michigan project uncovered the need for revisions to the first run of tests. These complexities, however, do not appear to have been of sufficient magnitude to cause the idea of incorporation of calculator use in state testing programs to be abandoned.

Maroney (1990) listed other state-based standardized tests which permitted calculator use; these include: Missouri Mastery and Achievement Tests, New York State Regents, California Golden State, Ohio Test for Scholastic Achievement, Kentucky Essential Skills Test, and Georgia Test for Teacher Certification in Mathematics.

There are a number of issues concerning calculator use that would apply to any norm-referenced standardized test of mathematics. These include equity concerns, administrative difficulties, and test design problems.

The concern with equity is multi-faceted. One early problem with allowing calculators to be used by students on standardized tests was the realization that not every student owned or had the financial wherewithal to own a calculator. This immediately put the evaluative fairness of tests in doubt; at least, when calculators cannot be used, the playing field itself is level, despite the different socioeconomic levels which comprise the testing population. If the organization which sponsors the test undertakes investment of purchasing calculators for the test-takers, the concern arises that unfamiliarity with the calculator may even detract from a student's performance on the test. Experimentation with calculator usage on standardized tests (such as the Second Mathematics Assessment conducted by the National Assessment of Educational Progress (NAEP)) in the early 1980's has shown that it is beneficial for students to test with calculators they are familiar with and have used during mathematics instruction.

Another equity problem results from the varying degrees of sophistication among calculators ranging from simple four-function models to non-programmable scientific calculators to programmable graphing calculators. Since the sophistication level of calculators is directly related to their prices, the fairness question once again raises itself. The existence of programmable graphing calculators poses difficulties for the administrators of standardized tests creating the fear that information useful to test questions could possibly be stored and carried out. One suggestion toward resolution of this security problem has been to develop a list of acceptable calculators. The list would be published before the test in application materials and the calculators brought into the test would be checked against the list. This idea has not been eagerly accepted mostly due to the cost in terms of time that would be imposed upon

test administration personnel at the test sites. For the ground-breaking 1994 SAT administration, the College Board has decided to allow "virtually any type of calculator" (Rigol, 1993). Both programmable and non-programmable and scientific and graphing calculators will be acceptable; what will not be permitted are any types of computers or calculators with communications capabilities. The present day affordability of hand-held calculators and the prevalence of ownership of calculators by students or their families has largely diffused the equity concerns that were once "paramount" (Rigol, 1991). Also, the mere fact that calculators will be allowed on the SAT should encourage increased classroom usage.

Another issue that standardized testing organizations must grapple with concerns the design of questions on a test where calculators are used to answer the questions. Kennelly (1989) pointed out some complexities of the situation: "psychometricians must certify that the examinations are measuring what they purport to measure" and that "when calculators are used during an examination, testing experts must be certain that the machine's ability to perform mathematics does not interfere with the test's ability to measure the candidate's performance."

Questions fall into three categories: (1) *calculator active* questions which require the use of a calculator to solve them; (2) *calculator inactive* questions which are best solved without a calculator; and (3) *calculator neutral* questions on which the effect of calculator use is undeterminable. Harvey (1989) proposed two definitions that could aid in test development:

1. *A calculator-based test item* (a) contains data that can usefully be explored or manipulated by using a calculator and (b) has been designed to facilitate active calculator use.

2. *A calculator-based mathematics test* (a) tests mathematics objectives, (b) has some calculator-based items, and (c) has no items that could have been but are not calculator-based, except for items that are better solved with non-calculator-based techniques.

Some proponents of calculator use on standardized testing predict a move away from routine computation and the incorporation of more realistic situation problems with believable data. Others advocate a move away from the prevalent multiple-choice format and into open-ended, exploratory problems, with some even offering a range of answers.

When calculators have been permitted on tests that have not been changed, i.e. when calculator-users and non-calculator-users take the identical test for comparisons of the results, two effects have emerged. One is that computation scores tend to rise - this is no surprise - although there exists the probability that wrong keys will be pressed, and the other effect is that time after time no significant differences have emerged in problem-solving sections of tests when calculators have been permitted and when they were not. It is strongly felt, however, that calculator use on problem-solving test items helps avoid careless errors and that they can help increase the rate at which these problems are solved.

For the 1994 SAT administration, the policy of the College Board is that calculators will be permitted, but that "no questions on the test will require the use of a calculator" (College Board Questions and Answers, 1992). In preparation for 1994, the College Board is advising students "not to try to use your calculator on every question" and "to decide how to solve each problem, then decide whether to use a calculator" (College Board Questions and Answers, 1992). Another issue is the problem of calculators breaking down during a test. But, if like the 1994 SAT calculators are not specifically required, there is nothing to prevent the student from successfully completing the test other than an absolute ignorance of pencil and paper procedures and Usiskin (1978) rejects this concern as a problem:

> It is common to cite the case of a real or hypothetical student who takes a calculator into an exam only to have the battery run out, after which the student is helpless and confused. Such events do happen. But when they do, one must ask two questions. First, will the student allow this to happen on the next test? One would expect that a single experience of this kind would suffice and that a similar experience would be avoided. Second, for how many students in the same test was the calculator an asset? In short, one should be careful not to penalize the majority (those with calculators) in a

test because of unwise decisions that are bound to be made by a few (those whose batteries run out).

When a computer or business machine breaks down in the real world, few organizations reject the idea of using the machine. Most get it quickly fixed, or they buy a new one. It is a fact of life that machines break down or are at times unavailable, but the increased level of performance that they make possible more than makes up for those inevitable problems.

Finally, the psychosocial impact of the issue of calculator use has been addressed by some writers. "When calculators are banned from tests, students are sent a message about the irrelevance of what they are learning in school to the world outside school" (Wilson, 1989). Heid (1988) wrote that "because calculators are not allowed on most tests, students conclude that the most important part of mathematics is learning to execute computational procedures by hand" and that "students who understood the mathematical concepts and principles could enter testing situations more confident of their ability to produce correct results [using calculators]." According to Reys (1987) "the availability of calculators acts as a control for varying levels of computational skills, serving as an equalizer. The availability of calculators on the noncomputational portions of standardized tests insures that students no longer face double jeopardy - being penalized twice for weak computational skills."

III. A Sample of Research on the Calculator in Mathematics Education

The two most well-known research projects on calculators in mathematics education were undertaken by Marilyn Suydam of Ohio State University and by Ray Hembree of Adrian College and Donald Dessart of the University of Tennessee.

Suydam's work, Electronic Hand Calculators: The Implications for Pre-College Education (1976), was funded by a grant from the National Science Foundation. The report was, as Suydam wrote, "designed to provide [information] on the range of benefits and reactions about calculators, and in particular on the arguments that were being used to support positions strongly favorable and strongly negative toward the use of calculators in elementary and secondary schools."

In her investigation, pursuant to the research design stated above, Suydam collected attitudinal data from educators which expressed (1) support for using calculators in school, and (2) opposition to using calculators in schools. Reasons in favor of calculator use were:

1. They aid in computation.
2. They facilitate understanding and concept development.
3. They lessen the need for memorization.
4. They help in problem-solving.
5. They motivate.
6. They aid in exploring, understanding, and learning algorithmic processes.
7. They encourage discovery, exploration, and creativity.
8. They exist.

Reasons against calculator use included:

1. They could be used as substitutes for developing computational skills.
2. They are not available to all students.
3. They give a false impression of what mathematics is.
4. They are faddish.
5. They lead to maintenance and security problems.

Richard Shumway, who collaborated with Suydam on this report, analyzed the above data which was derived from questionnaire responses and developed what he considered to be the actual arguments for and against the use of calculators in school:

Arguments for using calculators:

1. There will no longer be any need for the usual paper-and-pencil algorithms for the basic operations.
2. Scientific calculators will not be expensive.
3. Extensive drill and practice exercises will be unnecessary.
4. Decimals and scientific notation will be introduced early in first grade.
5. Mathematical exercises will be more realistic.
6. Calculators are fun.
7. The addition and multiplication algorithms for fractions can be delayed until algebra.
8. The calculator facilitates number sense.
9. Handheld calculators make calculations easy and practical for all children.
10. Handheld calculators stimulate interest in and facilitate the teaching of mathematical concepts.
11. The calculator can be used to facilitate problem solving.
12. Handheld calculators provide experience with the only practical algorithm which is used in society today.
13. Handheld calculators will place the emphasis on when and what operation to use.
14. There will be more interest in estimation.
15. The power of mathematics used by the common man [and woman] will increase astronomically.
16. More time will be available to teach mathematics in depth.
17. New topics in mathematics can be introduced into the curriculum.

Arguments against using calculators:

1. Handheld calculators would destroy all motivation for learning the basic facts.
2. The use of calculators would destroy the basic, mainstream mathematics of the elementary curriculum.
3. The cost of calculators prohibits their use.
4. Calculators are particularly inappropriate for slow learners.
5. The child's notion of the nature of mathematics would be changed.
6. The use of calculators would reduce children's ability to detect errors...no record of what was done.
7. Paper-and-pencil algorithms are still necessary, basic skills.
8. Batteries lose their charge and wear out.
9. The use of handheld calculators would discourage mathematical thinking.
10. Parents are unalterably opposed to the use of calculators in the schools.

Suydam reported that in the years prior to 1976 there had been roughly two dozen studies involving calculator instruction, but that many of these were not well designed and that often sample sizes were too small to provide valid inferences and generalizations. Suydam identified only five "transferable findings" which emerged from these studies:

1. Children can learn to use calculators.
2. Children generally enjoy using calculators.
3. Low achievers may profit from using calculators, but calculator use should not be restricted to low achievers.
4. Calculators can be used for checking paper-and-pencil computation.
5. Calculators may or may not facilitate particular types of achievement.

Recommendations for needed research were:

1. when and how to introduce calculators
2. effective procedures for learning basic facts, computational skills, problem-solving, and various mathematical ideas
3. effective calculator algorithms
4. long-range effects of using calculator algorithms
5. need for paper-and-pencil algorithms
6. effect of calculator use with specific content and curricula
7. effect of curricula sequence/emphasis changes
8. relationship between work with calculators and computers
9. changes in teacher education curricula
10. optimal calculator designs

As follow-up to the initial report, Suydam issued five "state-of-the-art reviews" during the years 1978-1982, inclusive. The purpose of these reports was to provide updated information on topics presented in the initial report and to provide information regarding innovations pertaining to calculator use in mathematics instruction. During this time, Suydam also established the Calculator Information Center at the Ohio State University.

State-of-the-Art Review on Calculators: Their Use in Education (1978) reported a wider use of calculators in mathematics education since the initial study in 1976. Suydam indicated that since the first report "the main question has been, "Should or shouldn't they be used on tests?" and even this is fading as an issue: teachers are using tests where calculators, available to all, are neither an aid nor a hindrance in terms of the goals being tested."

Predominant types of calculator uses were identified:

For elementary levels:

1. checking computational work done with paper and pencil
2. games, which...provide motivation
3. calculation
4. exploratory activities

For secondary levels:

1. calculation
2. recreations and games
3. exploration
4. use of calculator-specific materials

The Use of Calculators in Pre-College Education: A State-of-the-Art Review (1979) reported growing use of calculators in schools, even to the extent of competency with calculators being included on minimal competencies for graduation in some school districts. Suydam again brought up the testing question in this report:

> Another continuing concern is with the role of calculators on tests. In several other countries, calculator use has been allowed on standardized tests; this is not yet true in the U.S. There is a stalemate at present: it is not appropriate to use calculators on normed tests, since both tests and norms were developed without calculators being used. On the other hand, tests which allow the use of calculators will not be available until calculators are in much wider use.

Also highlighted in this review was the research topic of whether or not calculators in instruction were harmful to students' mathematical achievement as measured on standardized testing instruments. Suydam reported that the current studies were indicating no harmful effects resulting from the use of calculators in mathematics instruction, but that there were some limitations associated with the studies.

The Use of Calculators in Pre-College Education: Third Annual State-of-the-Art Review (1980) continued to address the issue of the relationship of calculators in instruction and achievement test scores. Suydam wrote:

> Data from the many studies (studies on achievement which comprise about two-thirds of all [calculator] studies reported) still seeking an answer to the question "Does use of calculators hurt achievement scores?" continue to support the fact that students who use calculators for instruction achieve at least as high or higher scores than students not using calculators, even though the calculator is not used on the test.

This review reported some results of surveys on beliefs and attitudes held by both educators and laypersons regarding different types of calculator uses. Seventy percent of teachers representing instruction at all grade levels were receptive to having calculators available to students. Suydam reported that "teachers generally agreed that slow students or senior high students who had never learned to compute should use a calculator because they would probably never be able to compute otherwise."

The Use of Calculators in Pre-College Education: Fourth Annual State-of-the-Art Review (1981) reported on a development which had taken place since the last yearly report: the overshadowing of the great calculator debate by the introduction of the microcomputer into instructional settings.

Research which focused on problem-solving with calculators produced the following findings:

1. Calculators are useful for problem-solving if the problems are within the range of students' paper-and-pencil computational ability.
2. Students are less afraid to tackle difficult problems when using calculators.
3. Students use more varied problem-solving strategies when using calculators.
4. There is no significant difference in the number of problems completed with or without calculators.
5. The use of calculators probably does not affect problem-solving scores significantly.

Suydam's final review, The Use of Calculators in Pre-College Education: Fifth Annual State-of-the-Art Review (1982), reported that although fears about calculator instruction had diminished, they "have not redirected the elementary curriculum, as once expected." However, it had appeared that by 1982, approximately 150 studies pertaining to calculators had been done. Of the 75 studies on comparisons of student achievement, with and without the use of calculators, "thirty-five percent evidence that students score higher when calculators are used, forty-four percent indicate there is no significant difference, and only three percent report that using calculators resulted in lower scores than using pencil and paper."

Suydam also addressed changes in attitudes of parents and teachers which occurred since her initial study in 1976. She reported that some 27 surveys had shown an increase in the level of acceptance of calculators. She also pointed out that "teachers' attitudes became increasingly positive after workshops or other inservice work."

In a doctoral dissertation (1984) which became well known in calculator research, Ray Hembree, under the supervision of Donald Dessart, performed a meta-analysis integration of 79 research reports for the purpose of assessing the effects of calculators on student achievement and attitude. The research was focused on the effects of calculator use compared with non-use on the acquisition of composite operational skills, productivity, selectivity, problem-solving skills, and attitudes toward mathematics. An additional "observational" research question was also included: "Is special calculator instruction better or worse than instruction within a traditional format without calculators?" The research was conducted with students in grades K through 12.

With respect to operational skills, the findings showed that "...the paper and pencil skills of low and high ability students who received a calculator treatment remained at par with those of the control group. For students of average ability, paper and pencil skills significantly improved after a calculator treatment, except in Grade 4, where paper and pencil skills were hampered by calculator treatment."

Regarding problem-solving skills, Hembree and Dessart found that "low and high ability students neither gained nor lost from the calculator treatment, but the paper-and-pencil skills of average students were significantly improved, though less in Grades 4 and 7 than at other grade levels."

Analysis of the attitude variable revealed that "significant positive effects were found for attitude toward mathematics and self-concept in mathematics." Conclusions of the research project included the following:

1. ...a use of calculators can *improve* the average student's basic skills with paper and pencil, both in basic operations and in problem-solving.
2. the use of calculators in testing produces much higher achievement scores than paper and pencil effects, both in basic operations and in problem-solving. The overall better performance in problem-solving appears to be a result of improved computation and process selection.

Among recommendations regarding classroom usage were:

1. Calculators should be used in all mathematics classes of Grades K-12.
2. Students in Grade 5 and above should be permitted to use calculators in all problem-solving activities, including testing situations. This recommendation is based on these two observations:
   a. Calculators greatly benefit student achievement in problem-solving, especially for low and high ability students.
   b. Positive attitudes related to the use of calculators may help to relieve students' traditional dislike of word problems.

Hembree and Dessart (1992) extended their original meta-analysis with nine additional studies of calculator usage and student achievement. The new data was found to either support or enhance previous findings. The new data showed that when students are allowed to use calculators on tests that measure achievement, there was:

1. continued advantage from calculators in computation; and
2. better advantage from the devices in problem-solving.

Two other research reports, both published by the College Board, have also provided valuable information on aspects of calculator usage.

Surveys of the Use of Hand Calculators and Microcomputers in College Preparatory and College Science Classes by G. Will Pfeiffenberger and Ann Marie Zolandz (1989) was designed to investigate the attitudes and beliefs held by secondary school and post-secondary school science faculty towards calculator use in physics, chemistry, biology, and other science courses. At the time of this research project, the College Board was seeking educator input as standardized test calculator policies were being considered.

Pertinent survey questions and responses are summarized below:

Question 1: This question asked teachers to indicate the uses of calculators in their courses.

Most of the physics teachers who responded...permitted [calculator] use for all types of course work and tests.

The result for chemistry was similar to that of physics. Most of the chemistry teachers who responded permitted [calculator] use for all course work and tests.

BEST COPY AVAILABLE

The percentage of biology teachers who allowed simple calculators on course work was sixty to sixty-seven percent. Forty-six percent of biology teachers who responded to this question said they allowed scientific calculators to be used on all tests.

Question 2: Do you have any concern about the use of calculators on standardized tests in general?

The main concerns were: students who bring information to the test in programmable memories, the equity issue (both availability and uniformity), dependence on calculator use, and the nonmastery or deterioration of skills. Some also indicated they thought calculators should be allowed on science tests (sometimes with the qualification that the concerns mentioned above be remedied), but should not be allowed on mathematics tests, which attempt to assess the skills that calculator use would replace. Some of the comments favorable to calculator use included:

1. Failure to use calculators is to live in the 19th century.
2. I don't see any value in making students do calculation on exams. Knowing how to set up problems is more important.
3. Slide rule, calculator, what's the difference as long as the student's brain does the programming?
4. If a student is merely a number puncher, he won't get the right answer anyway. In this day and time, intelligent use of a calculator is a necessary skill.

Another study undertaken by the Educational Testing Service to investigate the feasibility of changes to the SAT, Calculator Survey Report: The Use of Calculators in Urban and Rural Schools (1992) by Jane Marie Maroney, focused on the following points related to the equity issue:

1. the types of activities (e.g., homework, tests) for which calculator use is permitted
2. the degree to which college-bound students in urban and rural districts have access to and make use of calculators
3. the likely impact of using a calculator on test performance and on school policy.

Three groups were designated to participate in the survey: Group 1 - a random sample of six hundred rural and urban school administrators; Group 2 - five high schools each from ten major urban school districts; and Group 3 - the fourteen members of The Urban Mathematics Collaboratives which are located in major urban areas and which are dedicated to developing professionalism of mathematics teachers.

The results of the project included the following:

1. In response to the question which asked about current school policy on the use of hand-held calculators in mathematics classes, over seventy percent of Group 1 indicated that their policy permitted the use of a calculator on homework and classwork. However, in the area of testing the response was more conservative.
2. The type of calculator thought to be the most appropriate for use on the SAT was a non-programmable scientific calculator.
3. In response to the question which asked about the percentage of college-bound students that own or have regular access to calculators, over eighty percent respondents indicated that seventy-five percent of their students do own or have access to calculators.
4. The majority of urban and rural schools indicated that ninety percent or more of their students are able to use calculators for the basic operations.
5. Fewer than one-third of the respondents reported any concerns if the use of calculators were to be permitted on the SAT.

The researcher concluded that most educators favor the use of a calculator on the SAT.

Conclusion

The Interrelationship of Assessment and Instruction in Mathematics Education

According to Kennelly (1989), "standardized tests have achieved importance because they give independent benchmarks of educational achievement." One would assume that the writers of such tests take into account the vast body of knowledge being transmitted from teachers to students in the nation's schools, attempt to identify commonalities in that knowledge, and develop questions to check students' retention of and ability to apply that knowledge. However, the purveyors of the knowledge, the teachers and administrators, have a vested interest in the satisfactory performance of their students on such testing instruments. Therefore, a circular situation occurs such that testing follows instruction (for the purpose of constructing the test) and instruction follows testing (to ensure good performances by students). This is a schematic into which a "new" innovation like the hand-held calculator does not easily fit because to change one side of the equation requires a change of equal magnitude on the other side. Because the institutional structures for testing and instruction are discrete as well as diverse, it is difficult for change to occur.

The instructional side of the mathematics education coin was the first to deviate from the cycle by allowing calculators into the classroom for some limited usages. Ostensibly, this occurred as a result of the early, positive endorsement of classroom calculator use by such organizations as the National Advisory Committee on Mathematics Education (NACOME) and the Association of State Supervisors of Mathematics (ASSM).

As far back as 1975, NACOME recommended "that beginning no later than the end of the eighth grade, a calculator should be available for each mathematics student during each mathematics class. Each student should be permitted to use the calculator during all of his or her mathematical work including tests" (Keys, 1980).

In the NCTM's 1980 publication An Agenda for Action: Recommendations for School Mathematics of the 1980's, one of the eight recommendations stated that "mathematics programs must take full advantage of the power of calculators and computers" (Lilly, 1987). In 1986, the NCTM's Board of Directors recommended that all students use calculators to:

- concentrate on the problem-solving process rather than on the calculations associated with problems;
- gain access to mathematics beyond the student's level of computational skills;
- explore, develop, and reinforce concepts including estimation, computation, approximation and properties;
- experiment with mathematics ideas and discover patterns, and perform those tedious computations that arise when working with real data in problem-solving situations (Harvey, 1991).

In 1989, the NCTM published Curriculum and Evaluation Standards for School Mathematics; its developers having been charged with the task of "creat[ing] a coherent vision of what it means to be mathematically literate both in a world that relies on calculators and computers to carry out mathematical procedures." (NCTM Working Groups, 1989).

The Association of State Supervisors of Mathematics issued a position statement in 1990 which included the following "mathematics instruction should exploit the power and convenience of calculators and computers and the circumstances of testing should be compatible with the circumstances of instruction" (Position Statement, 1992).

Still, without official sanctioning by standardized tests, calculators have been slow to achieve complete integration into classrooms. While mathematics education professionals expressed the need for the development of materials written specifically for use with calculators, few materials of this kind were marketed. Textbook writers acknowledged the existence of calculators by providing a few supplementary exercises at the ends of problem sets. Carter (1987) felt that this situation signified a "curricular imbalance." Others worried that the implicit message being sent to students was that there was a lack of

connection between education and real-world experience. Suydam (1979) expressed the situation as a "stalemate" pointing out the inappropriateness of using calculators on normed tests, "since both tests and norms were developed without calculators being used. On the other hand, tests which allow the use of calculators will not be available until calculators are in much wider use."

As noted above, the stalemate has now been broken as a result of the College Board's initiative. Many state-based examinations permit calculator use, and the ACT program is seriously reviewing the issue.

Epilogue

This review of the literature on calculators in mathematics education was undertaken as the first step in an inquiry to determine the feasibility of using calculators on the national, standardized General Educational Development (GED) examination.

A literature search revealed no published articles on calculator use on the GED examination and only eight applicable articles dealing with calculator use on standardized tests in general. These articles were primarily concerned with the development of a calculator policy for the SAT and one addressed a similar ongoing process for the ACT examination. Most of the professional writing on calculator use in mathematics education was related to mathematics instruction in Grades K-12, as examined above.

What implications, then, does the extant research on calculator use have for adult education and the GED examination?

Successful passage of the GED examination is supposed to indicate acquisition of a body of knowledge possessed by seventy percent of high school seniors in the United States. (This percentage indicates what proportion of high school seniors can pass the GED examination). The GED examination, like other standardized tests, undergoes revisions as part of the norm-referencing process, to ensure currency with the high school curriculum. As elementary and middle school curricula are the foundation for high school, then instructional practices and innovations therein would most certainly have an impact on the nature of the high school curricula, and therefore, on the GED examination. If, in fact, as the literature overwhelmingly appears to indicate, calculators are being integrated into curricula at all levels and will now also be permitted on the best known pre-college assessment tool, the SAT, the field of adult education and the national GED administration should not delay participation in this inexorable trend. To do so would raise questions about the GED's relevancy to the entire educational spectrum in this country.

In conclusion, three sequential research topics are proposed:

1. Concurrent surveys of adult education teachers and students pertaining to extent of use of calculators in personal lives and to attitudes concerning calculator use in instruction and testing.
2. Field trials on calculator use on practice GED examinations, controlling for calculator instruction in GED classes.
3. Field trials on actual GED examinations.

As adult educators, we have the responsibility, as Heid (1988) expressed it, "to stop preparing students for the past and start preparing them for the future."

Bibliography

Adler, Jerry. "Creating Problems." Newsweek, Special Issue, 1991, 16-22.

Bartalo, Donald. "Calculators and Problem-Solving Instruction: They Were Made For Each Other." Arithmetic Teacher, 30, No. 5, (1/83), 18-21.

Bell, Max. "Calculators in Secondary School Mathematics." The Mathematics Teacher, (5/78), 412-413.

Berlin, Donna and Arthur White. "An Instructional Model for Integrating the Calculator." Arithmetic Teacher, 34, No. 6, (2/87), 52-54.

Boling, Mary Ann. "Some Cognitive and Affective Aspects of the Use of Hand-Held Calculators in High School Consumer Mathematics Classes." Dissertation Abstracts International 38A: 2623-2624; November 1977.

Branca, Nicholas, et.al. "Calculators in the Middle Grades: Access to Rich Mathematics." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 9-13.

Bright, George, et.al. "Statewide Inservice Programs on Calculators in Mathematics Teaching." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 217-255.

Bright, George, Ed. "Teaching Mathematics With Technology." Arithmetic Teacher, 38, No. 7, (3/91), 52-54.

Buchanan, Samual. "Mathematical Problem-Solving With and Without a Calculator and Its Effect on Alpha Activity." Dissertation Abstracts International 41A: 2981; January, 1981.

Callahan, Leroy, Ed. "What Are Calculators Good For?" Arithmetic Teacher, 34, No. 6, (2/87), 24-27.

Carpentar, Thomas, et.al. "Calculators in Testing Situations: Results and Implications from National Assessment." Arithmetic Teacher, (1/81), 34-37.

Carter, Betsy and Steven Leinwand. "Calculators and Connecticut's Eighth-Grade Mastery Test." Arithmetic Teacher, 34, No. 6, (2/87), 55-56.

Chambers, Donald. "Calculating the Influence of Tests on Instruction." The Mathematics Teacher, 36, No. 9, (5/89), 10-11.

Comstock, Margaret and Franklin Demana. "The Calculator is a Problem-Solving Concept Developer." Arithmetic Teacher, No. 6, (2/87), 48-51.

Countryman, Joan and Elizabeth Wilson. "Living in a Mathematical World." The College Board Review, No. 160, (Summer/91), 14-17 & 26.

Dick, Thomas. "The Continuing Calculator Controversy." Arithmetic Teacher, 35, No. 8, (4/88), 37-41.

Durant, Will and Ariel. The Age of Louis XIV, New York: Simon and Schuster, 1963.

Durant, Will. Our Oriental Heritage, New York: Simon and Schuster, 1935.

BEST COPY AVAILABLE

Finley, Karen. "Calculators Add Up to Math Magic in the Classroom." Calculators in Mathematics Education, Eds. James Fey and Christian Hirsch. NCTM Yearbook 1992, 186-194.

Frye, Shirley. "The NCTM Standards - Challenges for All Classrooms." Arithmetic Teacher, 35, No. 9, (5/89), 4-7.

Greene, Carole and Gretchen Rigol. "The Use of Calculators on College Board Standardized Tests." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 186-194.

Harvey, John. "Placement Test Issues in Calculator-Based Mathematics Examinations." The Use of Calculators in the Standardized Testing of Mathematics. Ed. John Kennelly. New York: College Entrance Examination Board, 1989.

Heid, M. "Calculators on Tests - One Giant Step for Mathematics Education." The Mathematics Teacher, 81, No. 9, (12/88), 710-713.

Hembree, Ray. "Research Gives Calculators a Green Light." Arithmetic Teacher, 34, No. 1, (9/86), 18-21.

Hembree, Ray & Donald Dessart. "Effects of Hand-Held Calculators in Mathematics Education: A Meta-Analysis." Journal for Research in Mathematics Education, 17, No. 2, (1986), 83-99.

Hembree, Ray & Donald Dessart. "Research on Calculators in Mathematics Education." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 23-32.

Hiatt, Arthur A. "Basic Skills: What Are They?" The Mathematics Teacher, 72, No. 2, (2/79), 141-144.

Higgins, Jon. "Calculators and Common Sense." Arithmetic Teacher, 37, No.7, (3/90), 4-5.

Hoffman, Kenneth. "Push Buttons, Not Pencils." The Charlotte Observer, June 29, 1991.

Hopkins, Martha. "The Use of Calculators in the Assessment of Mathematics Achievement." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 158-165.

Jaji, Gail. "The Use of Calculators and Computers in Mathematics Classes in Twenty Countries: A Source Document." Contractor's Report, Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, September, 1986.

Kansky, Bob. "The Calculator-Based Curriculum: Deceased or Just in "Suspended Automation"?" Arithmetic Teacher, 34, No. 6, (2/87), 4.

Kaiser, Elizabeth. "Calculators in the Classroom." Arithmetic Teacher, 39, No. 2, (10/91).

Kennelly, John. "A Historical Perspective on Calculator Usage on Standardized Examinations in Mathematics." The Use of Calculators in the Standardized Testing of Mathematics. Ed. John Kennelly. New York: College Entrance Examination Board, 1989.

Kennelly, John. The Use of Calculators in the Standardized Testing of Mathematics. New York: College Entrance Examination Board, 1989.

Kennelly, John. "Using Calculators in the Standardized Testing of Mathematics." The Mathematics Teacher, 83, No. 9, (12/90), 716-720.

Lappan, Glenda, et al. "Powers and Patterns: Problem-Solving with Calculators." Arithmetic Teacher, 30, No. 2, (10/82), 42-44.

Leinwand, Steven. "Calculators in State Testing: A Case Study." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 167-176.

Lilly, Marsha. "By Way of Introduction." Arithmetic Teacher, 34, No. 6, (2/87), 2.

Long, Vena, et al. "Using Calculators on Achievement Tests." The Mathematics Teacher, 82, No. 5, (5/89), 318-325.

Magee, Elaine. "The Use of the Minicalculator as an Instructional Tool in Applying Consumer Mathematics Concepts." Dissertation Abstracts International, 47A:455; August, 1986.

Manly, Myrna. "Teaching Tips for Tests: Mathematics Questions Teachers Ask." GED Items, September/October, 1991, 5.

Maroney, Jane Marie. Calculator Survey Report: The Use of Calculators in Urban and Rural Schools. New York: College Entrance Examination Board, 1992.

The 1981-83 Mathematics Examinations of the College Board. New York: College Entrance Examination Board, 1980.

"Mathematics Framework for California Schools K-12 Calculator Technology." Arithmetic Teacher, 34, No. 6, (2/87), 64.

May, Lola. "Making Calculators Count." Teaching K-8. (10/89), 16-18.

McAloon Ann and G. Robinson. "Using Calculators in Assessing Mathematics Achievement." Arithmetic Teacher, 35, No. 2, (10/87), 21-23.

Mercer, Joseph. "What is Left to Teach if Students Can Use Calculators?" The Mathematics Teacher, 85, No. 6, (9/92), 415-417.

Palmer, Henry. "Minicalculators in the Classroom - What Do Teachers Think?" Arithmetic Teacher, 25, No. 7, (4/78), 27-28.

Payne, Joseph. "The Effects of Calculators on State Objectives and Tests." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 177-185.

Ralston, Anthony. "Calculators for Teaching and Testing Mathematics." The College Board Review, No. 160, (Summer/91), 18-21 & 26.

Reiling, M. and G. Boardman. "The Hand-held Calculator is Here: Where are the Policy Guidelines?" The Elementary School Journal, 79, No.5 293-296.

Reys, Barbara. "The Calculator as a Tool for Instruction and Learning." New Directions for Elementary School Mathematics. Eds. Paul Trafton and Albert Schulte. NCTM Yearbook, 1989.

Reys, Barbara and Robert Reys. "Calculators in the Classroom: How Can We Make it Happen?" Arithmetic Teacher, 34, No. 6, (2/87), 12-14.

Reys, Robert, et al. "Hand Calculators: What's Happening in Schools Today?" Arithmetic Teacher, (2/80), 38-43.

Rigol, Gretchen. Telephone Conversation, April, 13, 1993.

Rigol, Gretchen. "Calculators and the SAT." The College Board Review, No. 160, (Summer,91) 22-25 & 26.

Rigol, Gretchen. "Balancing Educational, Administrative, and Equity Interests in the Development of a Calculator Policy for National Testing Programs." Paper presented at the annual meeting of the National Council on Measurement in Education, Atlanta, GA, April, 1993.

Saxon, John. "Classroom Calculators Add to Math Illiteracy." Wall Street Journal, May 16, 1986.

Saxon, John. "Say No to Calculators in Elementary Schools." Arithmetic Teacher, 34, No. 6, (2/87), paid advertisement.

Spiker, Joan and Ray Kurtz. "Teaching Primary Grade Mathematics Skills with Calculators." Arithmetic Teacher, 34, No. 6, (2/87), 24-27.

Super, Douglas. "Implementing Calculators in a District Mathematics Program: Three Vignettes." Calculators in Mathematics Education. Eds. James Fey and Christian Hirsch. NCTM Yearbook, 1992, 208-216.

Suydam, Marilyn. Electronic Hand-Calculators: The Implications for Pre-College Education. ERIC Document, ED127206.

Suydam, Marilyn. State-of-the-Art Review on Calculators: Their Use in Education. ERIC Document, ED171573.

Suydam, Marilyn. Telephone Conversation, March 30, 1993.

Suydam, Marilyn. The Use of Calculators in Pre-College Education: Third Annual State-of-the-Art Review. ERIC Document, ED206454.

Suydam, Marilyn. The Use of Calculators in Pre-College Education: Fourth Annual State-of-the-Art Review. ERIC Document, ED206454.

Suydam, Marilyn. The Use of Calculators in Pre-College Education: Fifth Annual State-of-the-Art Review, ERIC Document, ED220273.

Suydam, Marilyn. The Use of Calculators in Pre-College Education: A State-of-the-Art Review. ERIC Document, ED171573.

Ususkin, Zalman. "Are Calculators a Crutch?" The Mathematics Teacher, (5/78), 12-413.

Usiskin, Zalman. "Mathematics is Getting Easier." The Mathematics Teacher, (2/84), 82-83.

Vanetta, Glan and Lucreda Hutton. "A Case for the Calculator." Arithmetic Teacher, 27, No. 9, (5/80), 30-31.

Wheatley, Grayson and Richard Shumway. "The Potential for Calculators to Transform Elementary School Mathematics." Calculators in Mathematics Education. NCTM Yearbook, 1992, 1-8.

Wiebe, James. "Calculators and the Mathematics Curriculum." Arithmetic Teacher, 34, No. 6, (2/87), 57-60.

Williams, David. "A Calculator-Integrated Curriculum: The Time is Now." Arithmetic Teacher, 34, No. 6, (2/87), 8-9.

Wilson, James and Jeremy Kilpatrick. "Theoretical Issues in the Development of Calculator-Based Mathematics Tests." The Use of Calculators in the Standardized Testing of Mathematics. Ed. John Kennelly. New York: College Entrance Examination Board, 1989.

Yvon, Bernard. "A Compelling Case for Calculators." Arithmetic Teacher, 34, No. 6, (2/87), 12-14.

Appendix A: Pre Student Survey, January,1992

NAME_____ DATE_____

1. What is your goal?

2. List all the outside class activities you do that will help you meet your goal.

3. How do you think these activities help?

4. How much time do you currently spend outside of class on activities that will help you meet your goal?

5. How much time do you think you should be spending on these activities?

Appendix B: Post Student Survey

Interview Questions May 1992

What is your goal?

What can you do now that you couldn't do last year?

Was it helpful to complete the monthly calendars? Please explain.

Will you continue to use the calendars?

List all outside class activities you do that will help you meet your goal.

After reviewing your calendars, are you satisfied with the amount of time you spend outside of class on goal related activities?